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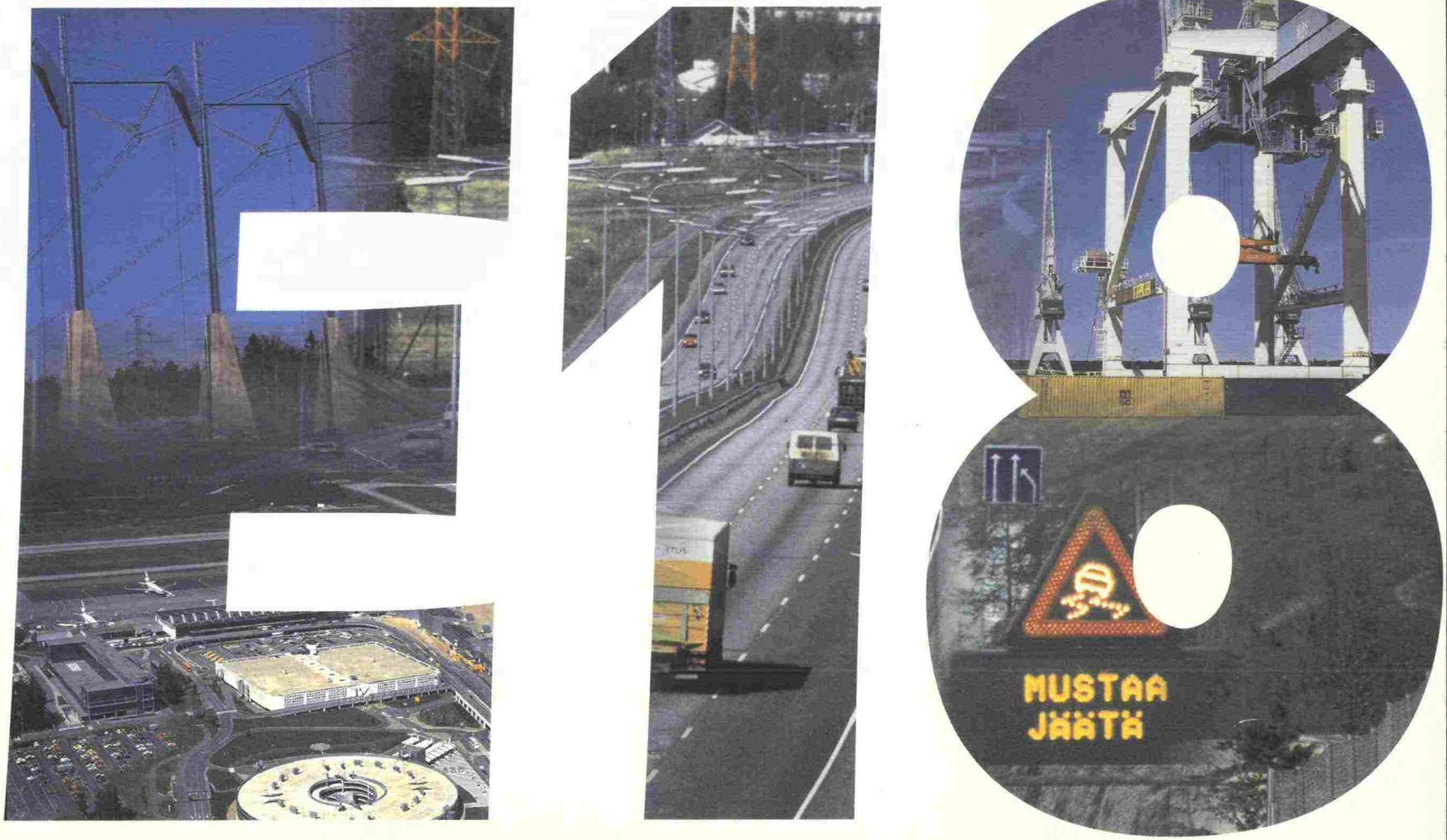
Development of European Road E18 in Finland

Situation in 1999



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LT CONSULTANTS

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FOREWORD

European Road E 18 in Finland is a road connection from the ports of Turku and Naantali through the Helsinki Metropolitan Area to the Vaalimaa border crossing. Route E 18 is mainly composed of national highways 1 and 7 as well as of highway 50 (Ring Road III). The nature of traffic and the detailed arguments behind the measures vary on the different road segments, but especially the European integration and the opening up of Russia have, in addition to single projects, emphasised the need for setting up ultimate objectives and common views in the development of Road E 18. Road E 18 is also a part of the Nordic Triangle which is one of the 14 prioritised development projects of transport infrastructure.

The Development Study European Road E 18 in Finland was completed in April of 1995. In this study, Road E 18, consisting of many road segments, was for the first time examined as a whole and as part of the transport system of many modes. The background included the integration of Finland to the European Union, the rapid growth of traffic volumes crossing the eastern border due to the changing conditions in Russia as well as several regional and local initiatives.

The implementation of Road E 18 during the past four years has mainly progressed according to the way presented in the Development Study. New road segments have been opened to traffic between Turku - Paimio, the western segment of Ring Road III and semimotorway between Koskenkylä - Loviisa. The construction of segment Paimio - Muurla is underway and the construction of the other carriageway between Porvoo - Koskenkylä will start in the autumn of 1999. Several experiments have been implemented on the road including e.g. variable speed limits based on weather conditions, guidance systems, eco-corridors etc.

The central objectives of this monitoring study included the updating of the forecasts and profitability estimates behind the development of the road as well as checking of the state of preparedness of the planning process. Also, public discussion on the development of the road was reviewed in the study and additional opinions were obtained for the most essential, open questions. In addition, the goal of updating the Development Study was to produce real time information for the interest groups in the impact area of Road E 18.

According to the main result of this study:

- the international and national significance of the road has been maintained or emphasised
- the development of the road has mainly occurred according to the goals set in the Development Study
- the traffic development forecasts behind the development of the road are still mostly accurate.

The actual development has corresponded to the estimates prepared in the year 1995. The most significant deviation from these estimates was the unexpectedly slower development of the Russian economy. The traffic volumes crossing the border have a significant impact mainly on the implementation of the easternmost segment of Road E 18. This is, however, planned to be the last E 18 project to be implemented.

The study has been directed by an Advisory Committee which had representatives from the Road Districts of Turku, Uusimaa and Kaakkois-Suomi as well as from the Central Road Administration. M.Sc. (Eng.) Leo Koivula has been the project manager of the study in the Finnish National Road Administration.

The study has been conducted by LT-Consultants Ltd (Doctor of Technology (Lic. Tech.) Kari Lautso, M.Sc. (Eng.) Timo Kärkinen) with the help of subconsultants, Kari Hietala (Kari Hietala Ltd) and special researcher Christer Pursiainen (Institute of International Affairs).

Helsinki, June 1999

Finnish National Road Administration

SUMMARY AND CONCLUSIONS

Development of Road E18 is included in European-wide networks which concern Finland

The Nordic Triangle is one of the 14 most important development projects of the TEN-networks defined by the EU. The Nordic Triangle connects the capital cities of the Nordic countries to each other, to the core areas of the EU and to Russia. Also, the extension of the Nordic Triangle a connection from Vaalimaa via St. Petersburg to Moscow - is included in the external projects which has a high priority by the EU.

The concept of Northern Dimension includes actions for securing the stability as well as the social and economic development in our neighbouring areas. One way is to connect the transport networks of northern Europe to the Trans-European networks. This will promote economic and other interaction.

Only minor changes in the traffic arguments for the development of Road E18

The ongoing strong migration to the growth centres and to the Helsinki Metropolitan Area will promote traffic growth in the western and central parts of the road.

The traffic development on Road E18 has so far corresponded well to the prepared forecasts and the development of domestic traffic seems to continue according to the estimates. The development of Road E18 attempts to respond to the traffic growth with well-timed solutions having proper dimensions.

The traffic crossing the eastern border increased according to the forecast, but the increase stopped in the autumn of 1998 due to the decline in the Russian economic conditions. The forthcoming possibilities for the development of eastern traffic will vary according to the development of the Russian economic conditions. According to almost all studied scenarios, the traffic growth between Finland and Russia will continue in the long run but the growth is expected to be slower than was previously estimated.

Traffic volumes crossing the border will have a significant impact only on the development of the easternmost road segment Hamina - Vaalimaa. This is the last segment to be implemented according to the implementation programme and its construction schedule will be determined based on the development of traffic volumes.

Implementation of Road E18 has proceeded according to plans

The implementation of Road E18 has mainly proceeded according to the way presented in the Development Study during the past four years. The road segments Turku - Paimio, Koskenkylä - Loviisa and Ring Road III between highway 1 - Vanhakartano have been completed during the years 1994-1998. The road segment between Paimio and Muurla is under construction and will be completed by the year 2002. The construction of second carriageway between Porvoo - Kosken-kylä will be started in the autumn of 1999.

The construction schedule is falling behind the time schedule prepared in the year 1994 at Hamina, where the final decision has not been made on the road alignment. After the decision, final road engineering can be started on this segment. Due to incomplete planning status, the implementation possibilities of the road have to be postponed also on some other segments. Currently, insufficient financing seems to postpone the completion of E18 road segments.

Several instances emphasise the development of Road E18

The development of Road E18 is included in the strategy plans of all the Regional Councils in southern Finland as the most essential infrastructure project. These plans constitute the base for the development of regions. In the common development strategy of the southern Finland coalition, which includes the seven southernmost Regional Councils, the implementation of Road E18 has been set a first priority out of the six top projects. The area of the southern Finland coalition has about 50 % of the population of Finland.

The business life of the area has also pressed forward the implementation of Road E18. The companies have, with the lead of the Chambers of Commerce, established a E18 Business Association which emphasises the significance of the road to trade and industry.

Also, the Russian authorities have emphasised the significance of Road E18 and have significantly improved the connection Vaalimaa - St. Petersburg - Moscow in the Russian side.

Traffic safety has been regarded as a problem on highway 7. The problems have often been related to the vehicle fleet in eastern traffic as well as to the attitudes and skills of drivers. This has caused insecurity in the area, and thus the residents of the area have demanded for faster improvement of the road.

The opponents of the project have based their arguments on the adverse effects to local environment and to some principal questions. These questions have been described in more detail in the appendix which deals with the press review of Road E18 and the discussion on the road.

Goals for the development of Road E18 have so far been achieved

The following goals have been set to the development of European Road E18 in the Development Study of 1995 and in other studies conducted after that:

Develop Road E18 according to the growth in demand to the level of the Trans-European Network (TEN) in the next 10-15 years which provides the road users with high, uniform and continuous service level, comfort and safety.

- The development of the road has progressed according to plans, while the implementation has been falling behind the time schedule.

Support the implementation of the development projects in the impact area of Road E18

- Information on the development and implementation schedule of Road E18 has been provided so that the timely implementation of the road has been prepared for in the impact area of the road.

Active development of intermodal cooperation

- Connections to the ports and airports in the Road E18 area have been improved and will be further developed by e.g. improving connections and increasing guidance.

Preparation of a service network construction plan of different phases which is based on the growth in demand

- A study on the development of the service network covering the entire Road E18 has been prepared which has been specified separately for every road district.

Considering of the special characteristics of the landscape of the areas in the planning and implementation of the project

- The prepared guidelines for planning have been considered in the planning of new segments of Road E18.

The task of the Road E18 environment is to express a "show window" of Finland in the future as well as to express Finnish architecture and design.

- Arrangements emphasising road landscape have been implemented in connection with E18 subprojects. For example, power line poles were designed as landmarks at the interchange of highway 1 and Ring Road III.

Modern experiments and applications of road and traffic technology as well as telematics will be applied to Road E18.

- Plenty of research, plans, experiments and practical applications on guidance, environment and the utilisation of transport telematics in compiling traffic and weather data, in traffic control and in communication have been conducted during the study period.

Ecocorridors as well as other structures providing easier movement of animals are part of the planning of the main road network. Monitoring of animal movements has been conducted at the implemented sites.

Weather guidance has been tested on Road E18 between Pyhtää and Hamina as well as between Lohjanharju and Salo, where speed limits are automatically set based on weather and road conditions.

As part of the telematic experiments, preparations have been made for adopting a RDS-TMC system (Radio Data System - Traffic Message Channel) on the main roads of southern Finland. It provides real time information on road works, accidents, congestion and road conditions to the display unit in vehicles. The data collection and transmission channels needed for this have also been created.

A park & ride experiment is underway in the Helsinki Metropolitan Area, in which guide signs along the main roads provide information on the possibilities of leaving a car at a park & ride lot and travel to the city centre by public transport.

Decreasing of travel times and improvement of traffic safety are the most significant traffic impacts

The implementation of Road E 18 will significantly promote smooth traffic operations and reduce travel times. Sufficient capacity will make the estimation of travel times easier and will reduce their variation.

Improvement of traffic safety on Road E 18 is also a significant traffic impact of implementing a motorway. For example, due to the implementation of the segment Muurla - Lohjanharju of Road E 18, the estimated number of fatalities will be reduced by about 50 and the number of injured persons by about 480 in the road network of the impact area during the following ten year period.

Traffic safety problems have occurred especially on highway 7 which have partly been caused by the large traffic volumes to the east. This situation has been examined by the provincial police management of southern Finland which listed several suggestions for improving traffic safety in its final report. One of the most important suggestion was the improvement of Road E 18 at Hamina and between Loviisa and Kotka.

Road E 18 is a profitable project as a whole, the profitability of subprojects vary

The completion of the remaining constructed or improved segments of Road E 18 are still profitable, although the most profitable development measures have already been implemented. The profitability varies between 0,6 - 2,7 depending on the road segment. The Ring Road III projects will have the highest profitability and Hamina - Vaalimaa project will have the smallest profitability.

The profitability estimates have been calculated for all road segments by using consistent methods. When evaluating the profitability estimates, it should specifically be noted that:

- profitability is strongly dependent on the implementation period and sufficient financing during construction
- cost estimates have been updated by considering e.g. more extensive environmental investments than previously
- estimated benefits include savings in time, vehicle and accident costs as well as in environmental costs
- employment benefits, multiplier effects or possible network, productivity, competitivity, market area etc. benefits for the business life have not been otherwise considered, unless they are included in the factors of the previous point.

EIA - process has promoted the influence and participation possibilities of citizens

Seven environmental impact assessments have been conducted for E 18 subprojects during the period of 1994-1999. The most important questions of the impact assessments have been related to noise, landscape, vegetation and fauna as well as to land use, ground water protection and the mitigation of adverse effects.

The process has promoted the possibilities for citizen participation and has had a concrete impact on improving the presented plans. It has also started the monitoring process of impacts.

The Ministry of Transport and Communications has prepared a strategic environmental impact assessment for the entire connection in the year 1996 which examined the Nordic Triangle transport corridor as a system of several modes of transport.

Employment benefits of 12 000-15 000 man years

The employment benefits of the construction of Road E 18 with multiplier effects are estimated to be 12 000 - 15 000 man years. Road construction is one the sectors with largest employment benefits which can be influenced on by state measures. The price of a man year is 360 000 - 450 000 FIM. Significant national savings can be achieved if the implementation occurs during underemployment conditions. About 130 permanent jobs is estimated to be located in the E 18 area.

Technical preparedness for developing Road E18 to a motorway standard by the year 2010 has been maintained

An implementation schedule was prepared for the Road E18 in the Development Study, according to which the entire road connection will be constructed to a motorway standard by the year 2010. This will not be possible by using the existing annual financing, but new financing methods will be needed which will enable a faster construction of projects than previously.

These methods include the aggregate and DBFO financing methods. With regard to implementation, the basic idea for both methods is that there will be enough financial resouces for the road construction during the whole construction period so that the project can be implemented in optimal time schedule. Using this method, the construction time of large road projects can even be reduced to a less than half. In this way, the new road will start to provide benefits several years before the original time schedule.

The new financing methods will also provide for a more efficient road development. Construction costs can be reduced by 10-15 % using these methods. The budget decisions on the development of the projects are still needed.

The preparedness in the planning of the road has so far met the budget resources committed to the implementation of the road. The incomplete planning status can create a bottleneck for some segments in the future. The Hamina by-pass road will constitute the biggest problem which still awaits for the principal solutions.

1. INTERNATIONAL AND NATIONAL ROLE OF ROAD E 18

1.1 Road E 18 as part of the European transport system

The EU competes with the other leading economic blocks of the world. The most important of them are North America and Southeast Asia. In order to succeed in this competition, the EU also has to exploit the external opportunities of its area. These are especially provided by eastern Europe owing to e.g. its vicinity, natural resources and educated employment. The integration to the east will extend market areas which provides for both the benefits of the economies of scale and specialisation opportunities.

Integration, the free movement of services, goods and people demand good transport connections. On the other hand, good transport connections will accelerate the integration development. The development of the Road E 18 will promote this integration policy both inside the EU as well as more extensively towards eastern Europe.

The EU, in cooperation with its member states, has defined the structure of its main transport networks (TEN) for supporting the integration development. In this way, also the parts of the Finnish transport network, which belong to the Trans-European Network, have been defined.

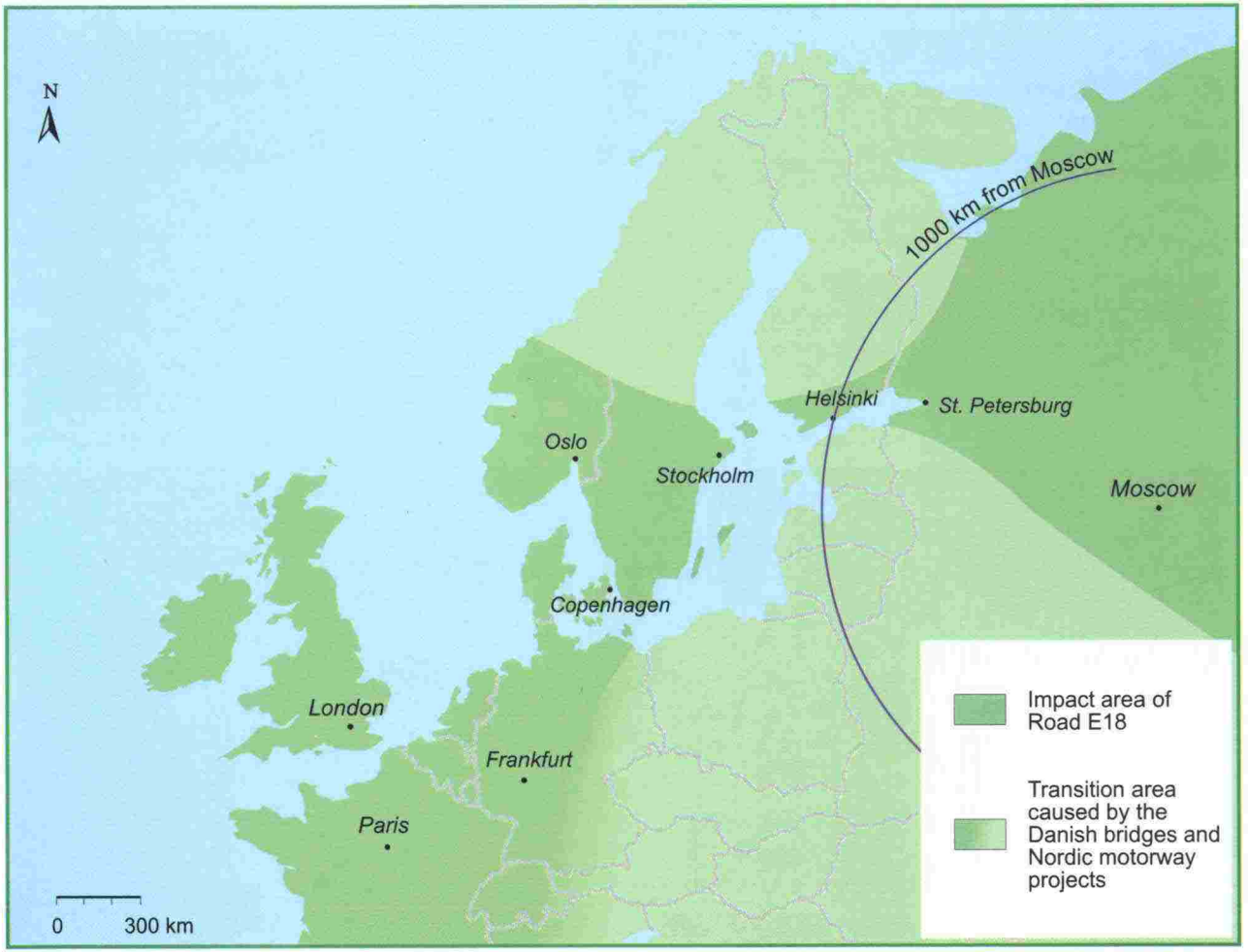
In addition, 14 European priority projects have been defined, one of which is the so-called Nordic Triangle. The Nordic Triangle connects the capital cities of Finland, Sweden, Norway and Denmark to each other and further on to central Europe and Russia. Road E 18 is an essential part of the Nordic Triangle and the connection Turku - Helsinki - Vaalimaa is the most important part of the Nordic Triangle in Finland. The Nordic Triangle is a system of many modes of transport. The essential parts of it include roads, railways, ports, terminals and airports.

The E 18 road segment between Vaalimaa - St. Petersburg and its extension St. Petersburg - Moscow are included in the external projects which are supported and have a high priority by the EU.

The setting presented above has remained and become stable since the preparation of the Development Study in the year 1995. New issues and emphases with regard to the European transport policy and the development of the Road E 18 include:

- creation of the Northern Dimension concept which emphasises the consideration of the special conditions of the North and the utilisation of the Nordic possibilities in the EU policy
- Kioto Agreement which limits the carbon dioxide emissions. The emission limitations are unevenly divided to different countries and different sectors of economy but they may also have an impact on the transport sector by restraining traffic growth. The share of transport in energy consumption is 18 % in Finland, while the average share is 29 % in the EU countries.
- Further emphasis on environmental values and the principles of sustainable development. This is reflected in the strong development desire of e.g. more environmentally friendly modes of transport (waterway traffic, railway traffic) for promoting their competitiveness to road traffic. The interconnection between traffic growth and the increase

Nordic Triangle



Impact area of Road E 18

in the national product should be discontinued. This can be achieved by developing and implementing several measures simultaneously. The measures under study include e.g. fair and efficient pricing of transport, intermodal cooperation, freedom of competition, telematics, telecommuting, land use planning and transport system management.

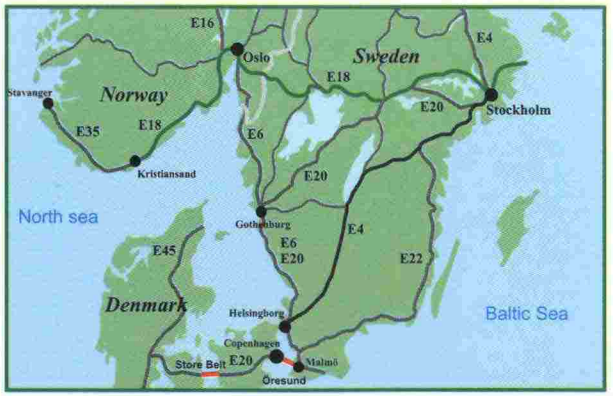
Connections, such as the Berlin - Moscow axis, which will be developed between central Europe and eastern Europe, will compete with Road E 18 for the international transports. Slow border crossing operations and other factors, which impair the level of service are, however, typical to the use of these connections. Road E 18 will always have a typical impact area of its own, despite the development of competing connections. The needs of domestic internal traffic as well as the import and export traffic of Finland are, however, of central importance when examining the qualifications of the road.

1.2 Nordic Triangle and the development of the Nordic transport system

The development of the Nordic Triangle is the most important international transport project in the Nordic countries. In addition to the Nordic Triangle, other important international connections which should be developed include:

- Via Baltica - a connection from Finland to Poland through Estonia, Latvia and Lithuania
- Helsinki - Vaalimaa - St.Petersburg - Moscow (Corridor IX)
- waterway connections in the Baltic Sea
- Barents Euro-Arctic transport area.

The most important Nordic Triangle **road projects in Sweden** include Road E4 Stockholm - Helsingborg (- Copenhagen) and E18 connection between Stockholm and Oslo. A share of 84 % of the Stockholm - Helsingborg connection is currently of motorway standard. According to plans, this share will increase to 96 % by the year 2007.



European road network in other Nordic countries

About 30 % of the segment Stockholm - Norwegian border is of motorway standard and this share may increase to 39 % by the year 2010. Traffic volumes on Road E18 crossing the border between Norway and Sweden are small, only about 2200 vehicles/day.

Expensive investment plans are connected to the Road E18 in the Stockholm region. Financing methods based on user fees are discussed both in Sweden and Norway in order to promote the implementation of transport projects. Road toll systems have already been implemented in Norway.

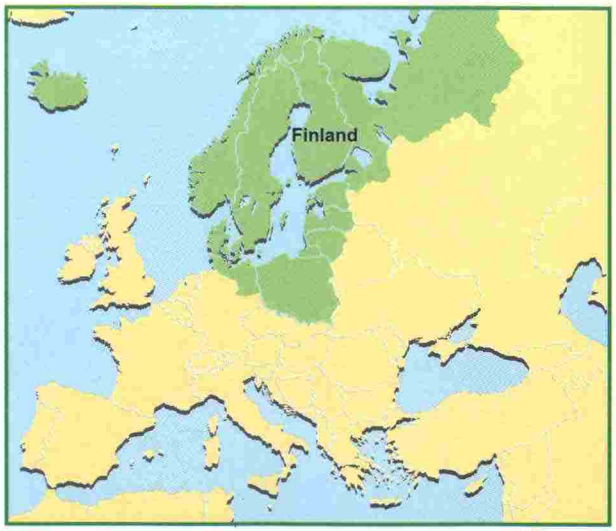
The most significant single projects of the Nordic Triangle include the construction of fixed railway and road links across **the Danish Straits** of Great Belt and Öresund. The Great Belt connection was opened to railway traffic in the spring of 1997 and to road traffic in the summer of 1998. The Öresund connection is estimated to be completed in the summer of 2000. Other significant projects are linked to the Öresund connection, such as the motorway segment by-passing Copenhagen, which is mainly completed, the extension of the Kastrup air terminal and the railway connection between Kastrup and Copenhagen. The latter also supports the new Örestad suburban area which is being built between the centre of Copenhagen and Kastrup airport and through which the Öresund fixed link is aligned. The total cost of the those fixed links is about 30 billion FIM.

Due to the fixed link, the Copenhagen - Malmö region will constitute a common economic area. The connections will improve the competitive advantage of Denmark and especially Sweden in the transport sector, while the position of Finland will become relatively weaker.

There is a motorway connection from Copenhagen to Hamburg and further on to the main road network of central Europe.

The Northern Dimension is a full concept, which assists in the attempt for developing the EU policy and for specifying its benefits in promoting the objectives of Finland and the European Union under the changing conditions of northern Europe. The concept includes the actions for securing the stability as well as the social and economic development in our neighbouring areas.

The transport networks of northern Europe are linked to the Trans-European networks but they are also regarded as multidimensional transport



Area of the Northern Dimension

and cultural corridors. The focal points of development include the Nordic Triangle or the transport connections (roads, railways, sea traffic, ports) between the capital cities of the Nordic countries, Helsinki - St. Petersburg - Moscow corridor as well as Via Baltica, a transport connection to Warsaw via Vilnius.

1.3 Development of Russia and Road E 18

The national or international starting points for the development Road E 18 have not significantly changed since the year 1995 with the exception of the unexpectedly huge migration in Finland and the elements of uncertainty related to the impacts of Russian development. The estimate made in the year 1995 about the development of Russian traffic was accurate but several elements of uncertainty were included in the estimation process. The state of uncertainty still prevails. The sudden economic collapse of August 1998 demonstrated that the direction of development can change rapidly. As the development scenarios of Russia are important especially to the eastern regions of Finland and the easternmost segments of Road E 18, and as the traffic development includes more elements of uncertainty than usually, the Russian development has been studied in more detail than e.g. the development of the EU or the Nordic countries. The following study is mainly based on the estimates of the Institute of International Affairs about the development alternatives of the political and economic situation in Russia. Finally, based on these, a conclusion has been made on the traffic development.

Alternative development scenarios of Russia

Estimating of the future in Russia has become more and more fine-tuned outlining of scenarios during the decades. Scenarios have been presented in the sectors of economy, financial policy, political system, regional policy, social policy, foreign policy etc. It is possible to distinguish several alternative short-term or long-term scenarios in every sector. It is evident that the outlook of these sectors constitute a "jungle of possibilities". It is very difficult to come up with a reliable overview of their mutual probability order or actual consequences.

Scenarios are necessary in order to create a basis of some sort for estimating the forthcoming development of Russia. They can be seen as strategies selected by the political management which aim at certain combinations of political and economic system. In addition to these more or less controlled estimates, different chaos scenarios can be introduced. Based on this, at least six alternative possible estimates can be distinguished.

- Existing uncertainty and the resulting aimless situation will continue
- Regions will take the actual power, political and economic systems become separated
- Increasing authoritarianism, return to controlled economy
- Russia will become democratic, market economy will be established
- Increasing authoritarianism, aiming at market economy
- Chaos

The above listed order indicates the estimated probability of the scenarios. The scenarios have partly different time span and some of them may overlap or follow each other.

Preconditions for development

When outlining alternative scenarios about the future of Russia, it has to be considered that all of them will occur under more or less permanent preconditions.

1) After the optimism of early 1990s, we cannot presume any more that the "economic miracle" of Russia will occur rapidly, but it can take decades. The crisis of August 1998 revealed the weakness of the Russian economy to external effects, especially to the Asian crisis and the decline in oil and raw material prices. This crisis restarted inflation which finally led to about 70 % annual inflation in the year 1998.

2) The export of raw materials, mainly oil, natural gas and metals, is primarily directed to Europe. This export dependence is likely to keep Russia interested in maintaining good foreign trade relations.

3) The economic significance of Russia in the world economy is relatively small. The relationship between Russia and the outer world can be expressed by the fact that only less than three percent of the EU exports outside of the EU area are directed to Russia, whereas the EU is the most important area for Russian exports with a share of over 40 percent of the total.

4) The western countries have strong political rea-

sons to promote solutions to the Russian economic crisis. According to the worst situation, Russia would be disintegrated. This could lead to e.g. refugee problems and to the threat that access to mass destruction weapons is not controlled.

Development of the northwestern economic area of Russia

The future of St. Petersburg or the northwestern economic area of Russia is closely connected to the general development of the country. In some alternative scenarios, the own solutions of the area have, however, a more significant role than in other scenarios. Of the above mentioned scenarios (if chaos scenario is disregarded), only the model based on authoritarianism promoting state regulation is the one that would not leave too much freedom of action to areas in their economic policy.

The northwestern economic area as a whole is one of the most reformist and most open Russian area for international business activity and other cooperation. It has also an ideal geographic location as a neighbour to a developed EU country. In addition, St. Petersburg together with the Leningrad and Novgorod regions are known for being western-minded. In a study of 1996 by the Centre of Finnish Business and Policy Studies, entrepreneurs and officials of St. Petersburg were asked, "which connection projects through Finland should also be financed by Russia". A highest priority with a share of 60 % was given to the Helsinki-St. Petersburg motorway project. Great prospects are set to increasing of the port capacity of St. Petersburg and the related growth of transit traffic through the port.

According to the latest statistics, St. Petersburg is ranked third after Moscow and Siberian energy centre of Tjumen, as far as foreign investments are concerned. However, it has to be noted when examining this relatively good rank, that the share of St. Petersburg is only about 4 percent, while Moscow receives almost 60 percent of all foreign investments. The increase in investments was 4 percent in the year 1997, while foreign investments had a share of about 1/7 of all investments. The most foreign investments in the year 1997 were made by American companies (35%), Finnish companies were ranked second (22 %), British companies were ranked third (9 %) and Austrian companies were ranked fourth (9 %). The share of imports of the consumer markets in St. Petersburg was 2/3 in the year 1997. More than half of this composed of foodstuffs.

Although the economic significance of Russia is small in general, Russia is of greater importance to some countries, such as Finland. In the foreign trade of the year 1997, Russia had a share of 6 percent of Finnish exports and a share of 8 percent of Finnish imports. The annual growth of exports to Russia has been greater than to other export countries. The Finnish industrial sector expects that the share of exports to Russia can increase to 10 percent if the economic situation improves in Russia. Especially, small and medium-sized companies have increased their share. The biggest problems are related to payment transactions, financing and guarantees as well as different barriers to trade.

Machinery and transport equipment constitute about a third of the Finnish exports, foodstuffs have a slightly smaller share. Almost half of the imports constitute of energy. Another large import group is timber having a share of about 10 percent. Also, ores, scrap metal and metal products are imported in large quantities.

Even after the crisis of the year 1998, the Finnish companies engaged in eastern trade still have a strong confidence in Russia as a market area. According to a questionnaire, a share of 96 percent of the companies have confidence in Russia in the long run and only a share of 4 percent have lost their confidence. Almost 60 percent will retain their activity also during the next few months, about 15 percent will even increase their activity and only about 25 percent will cut down their operations in Russia.

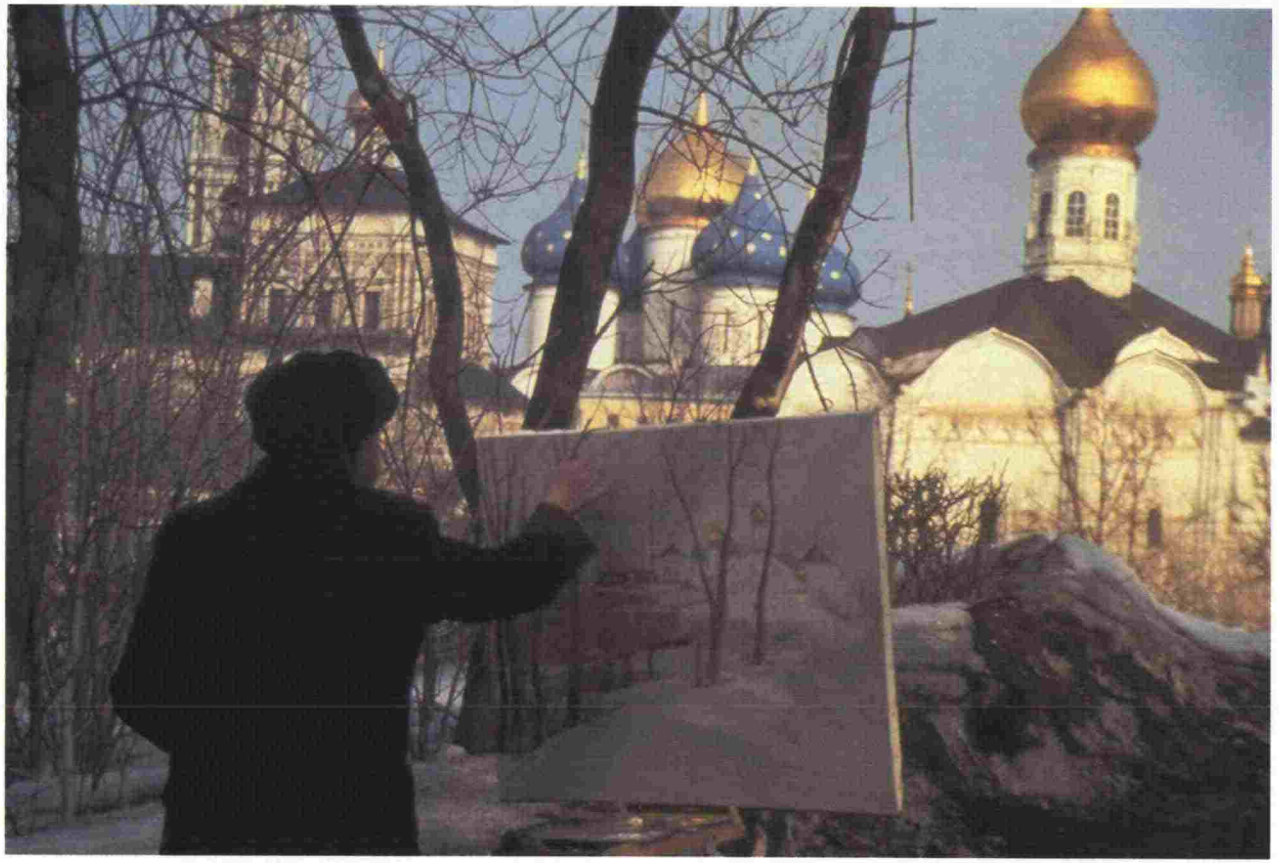
This gives a reason to believe that there is plenty of growth potential in the cooperation between Finland and the northwestern area of Russia regardless of the future development scenario in Russia - excluding the extreme chaos scenarios. At the same time, it should be considered that Finland still has, even after the next areal expansion of the EU, a functioning gateway position from the EU not only to the direction of St. Petersburg but also to Moscow.

Traffic development

The following should be considered when estimating the traffic development between Finland and Russia. Most of the economic and political scenarios can lead to the similar end result - traffic growth. Only chaos or the closure of Russia (which cannot be considered probable due to the dependence on western trade) can lead to unexpected consequences. When comparing the development of traffic volumes to the development of the national product in Russia during the 1990s, it can be noted, that traffic volumes have increased even though the economic development has been declining. This growth is due to the fact that some economic sectors have reached the growth path and groups of well-to-do citizens have been formed.

If Russia returned only to slow growth path (for which it would have a possibility due to its natural resources and educated employment), this would cause a strong growth "spurt" in the traffic between Finland and Russia. A 1 % growth in the GNP of Russia will result in about 4 % annual increase in export sector. In addition, special attention should be paid to those economic sectors which experience faster growth than average.

The forecasts prepared in the Development Study of 1995 have been very accurate until the economic collapse of Russia in August of 1998. The traffic between Finland and Russia can, however, be expected to develop further according to the forecasts prepared for the Road E 18 as soon as the economic conditions in Russia become stable again. The traffic growth will be connected to the so-called transit traffic phase, phase of bridgehead position and will end to a situation in which traffic between Finland and Russia will follow normal regularities between the two countries. Currently, the estimated time span for reaching the end situation is, however, longer than was expected in the year 1995, and thus the forecast of the growth rate of Russian traffic should be smaller.

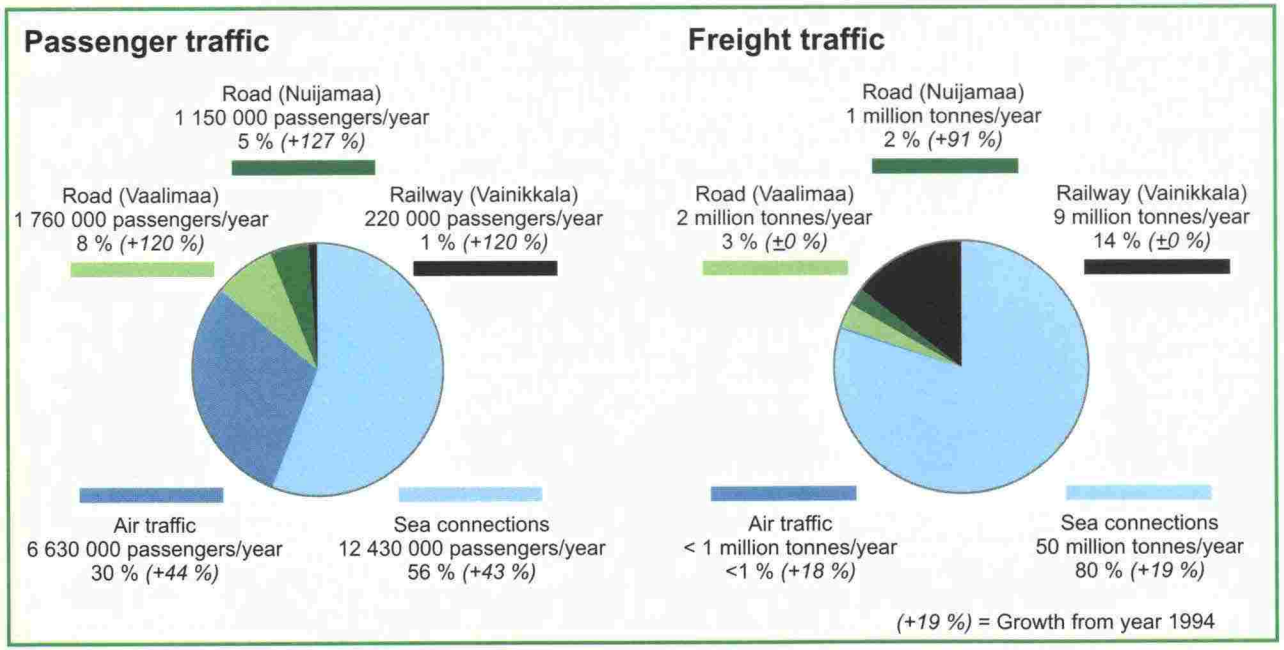


1.4 E 18 transport corridor in Finland

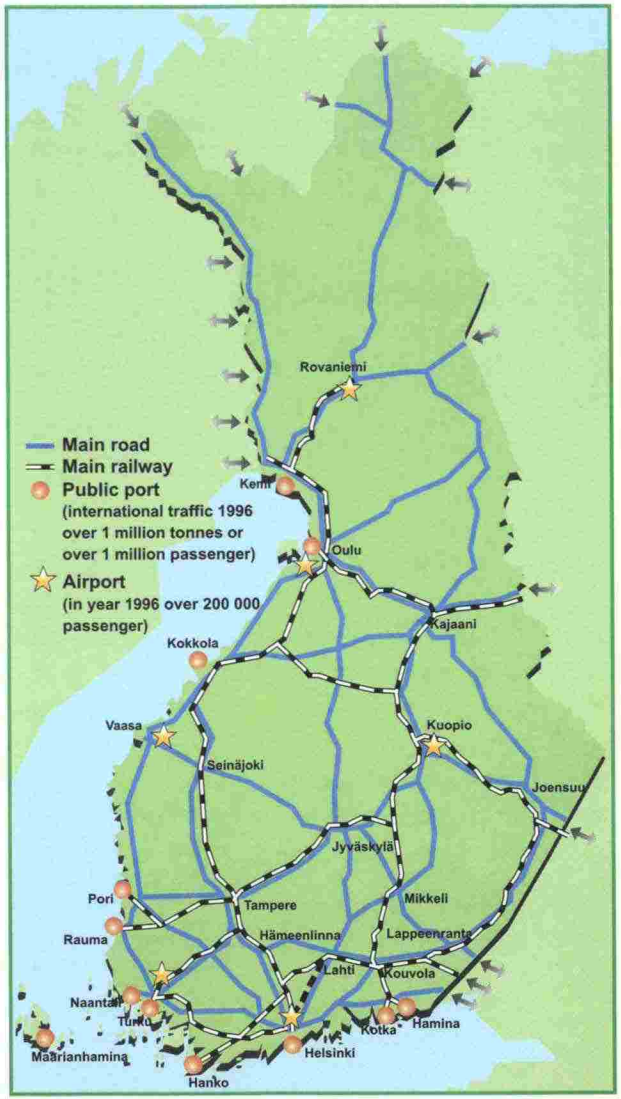
Road E 18 has a central role in the transport system of southern Finland consisting of all modes of transport, as it serves all ports on the southern coast as well as the most important airport of the country. In addition to international traffic, the task of the transport corridor is to serve domestic and local traffic as well as to connect the cities on the southern coast to each other and especially to the capital city of the country. The following describes the international traffic of Road E 18 and the development of the connections serving it. The role of Road E 18 in serving domestic traffic is described in chapter 4.

A share of about 77 % of the international passenger traffic and a share of about 66 % of the international freight traffic of Finland use the services of the transport corridor.

The development of the Nordic Triangle railway network has been programmed for the years 1997-2010. Railway development includes e.g. improving of track geometry which will enable increasing speeds of trains. The Ministry of Transport and Communications in Finland decided in January of 1997 to continue the planning of the direct railway link to Lahti along the alignment presented in the preliminary engineering plan which follows most closely to the Lahti motorway.



International traffic volumes of the Nordic Triangle in Finland in the year 1998



Main transport network in Finland as shown in the report Finnish transport system 2020

The port of Turku, which specialises in part cargo and passenger traffic and is the second most significant port by turnover, as well as the port of Naantali, which in turn specialises in liquid and bulk goods, constitute a single port area at the end of the same sea route from Europe. The port of Turku will expand and simultaneously the nodal point of freight traffic will shift over time closer to Naantali in the Pansio area where a port general plan has been prepared. The train-ferry traffic, which was previously operated from Hanko and Uusikaupunki, has concentrated in the Pansio port in recent years.

The ports of Kotka and Hamina have been expanded during the past four years and extension projects are still underway and under planning.

The final engineering plans for the transport connections to the Vuosaari port in Helsinki have been completed. The first phase of the port is planned to be completed during the year 2005 when the port operations can be moved from Länsisatama to Vuosaari.

The third runway at the Helsinki-Vantaa airport will be completed in the year 2002. There were a total of 11 million passengers in the year 1997. The forecast for the year 2015 is 20 million passengers and for the year 2025 a total of 30 million passengers.

E 18 transport corridor in Finland

The oil pipeline from Russia to Finland has been planned for a long time. The goal is to provide the Fortum refinery annually with 10-12 million tonnes of oil via the pipeline. Half of it would be refined and the rest of it would be transported abroad. The construction costs of the oil pipeline from the Finnish border to Porvoo will be about 750 million FIM.

2. TRAFFIC AND ITS DEVELOPMENT

2.1 Transports and passenger traffic in E 18 corridor

Transports

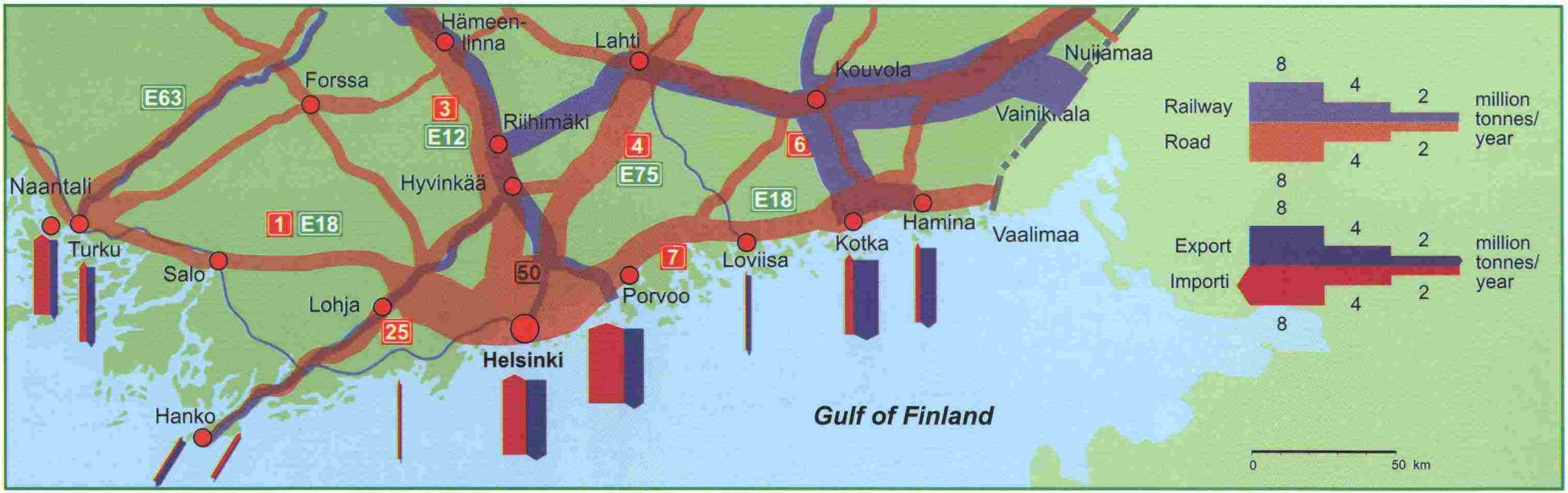
About 50 million tonnes of freight was transported through the Finnish **ports** on the southern coast in the year 1998 which was 25 % more than in the year 1994. Since the year 1997, traffic volumes increased significantly only in Sköldvik and Loviisa.

The share of transit traffic of the total traffic in the ports on the southern coast was 8 % in the year 1998, as it was 10 % in the year 1994. The transit traffic volume in tonnes was almost the same in the year 1998 as compared to the year 1994. A share of 90 % of all transit traffic in Finland was transported through the ports of southern Finland in the year 1998.

In the year 1998, 2 million tonnes of freight was transported by **road** through the Vaalimaa border crossing (1,4 million tonnes in the year 1994). A share of 77 % of this traffic constituted of exports to the east. Less than 1,1 million tonnes of it was transit traffic and a share of 93 % of it was directed to the east (80 % in the year 1994). The share of exports decreased by 25 % and the share of imports decreased by 6 % when compared to the previous year.

The amount of road transports have more than doubled at the Nuijamaa border crossing since the year 1994. There were about 1,5 million tonnes of transports at Nuijamaa in the year 1998. A share of 80 % of them constituted of imports to the east. The share of transit traffic was 26 %.

The transit traffic by road increased substantially until the beginning of the year 1998. After that, the volumes decreased by about a quarter until the summer. After August of 1998, transit traffic by road decreased to a share of one-fifth of the level in the beginning of the year due to the declining economic situation in Russia.



Freight traffic in E 18 corridor

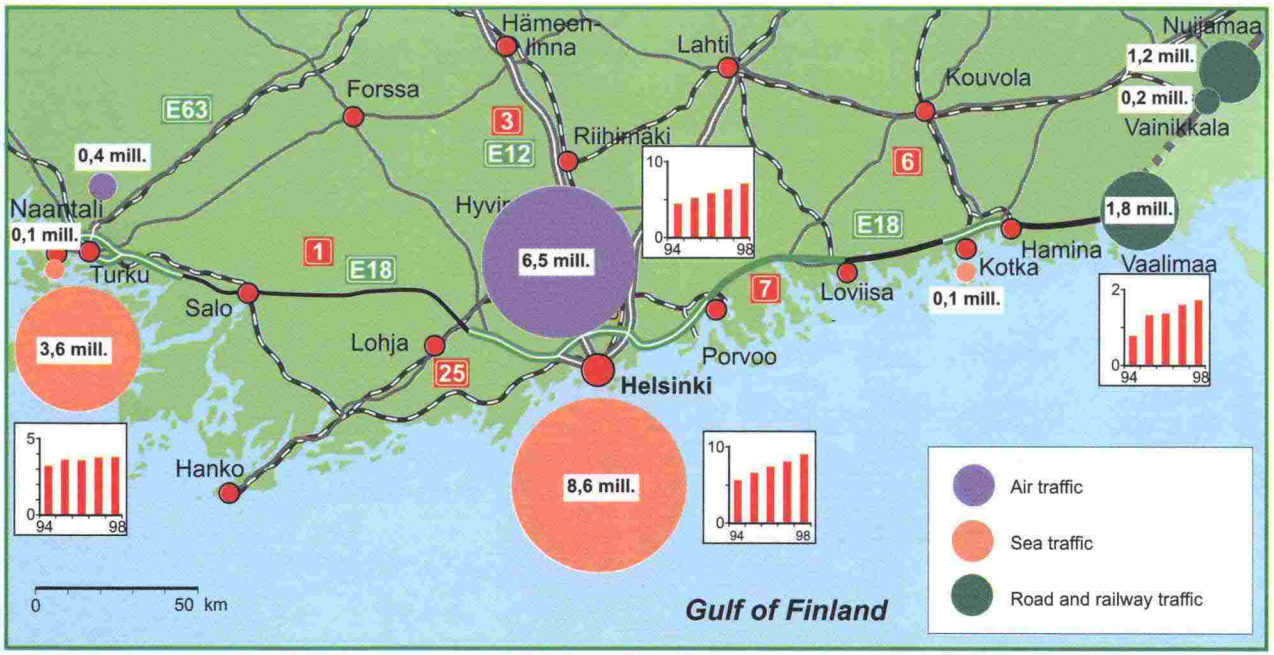
Road transports to Russia mainly consist of piece goods (foodstuffs and consumer durables). Timber is imported from Russia by trucks.

In 1998, a total of 8,7 million tonnes of freight was transported by **rail** through the Vainikkala border crossing which is slightly more than in the year 1994. The share of imports was 90 % which was exactly the same in the year 1994. The share of transit traffic of all freight traffic crossing the border in Vainikkala was 30 % in the year 1998.

Transit traffic by rail crossing the border, which is transported through the Finnish ports to other countries, consists of bulk goods (chemicals, fertilisers and oil products). This traffic is mainly directed through the ports of Kotka and Hamina.

A total of 410 000 containers were transported through the ports of southern Finland in the year 1998. A share of 57 % of them was transported through the port of Helsinki. One container contains an average of 13 tonnes of goods.

The share of **air traffic** of the freight transport tonnes in the E 18 corridor is less than 0,1 %. The share of the value of imports by air was 11 % of all imports to Finland in the year 1998. The share of air freight has increased in the recent years. It should be noted that the more congested airspace in central Europe promotes the possibilities for using the air routes of Finland.



International passenger traffic in E 18 corridor

Passenger traffic

There were about 21 million international passengers using the E 18 corridor in the year 1998. The corresponding volume was 15 million passengers in the year 1994.

The busiest international terminal in the year 1998 was the port of Helsinki which had a total of 8,6 million passengers. The rate of growth was 62 % from the year 1994. The number of passengers in the port of Turku has remained in about 3,5 million passengers in recent years.

Shares of 61 % and 36 % of all trips in sea traffic were directed to Sweden and Estonia, respectively. The greatest increase from the previous year occurred in the traffic to Estonia.

The international air traffic is centered at the Helsinki-Vantaa airport which had a total of 6,5 million international passengers in the year 1998. Traffic has grown by about 41 % from the year 1994. The share of passengers in regular flights was over 80 %.

The airport of Turku had a total of 162 000 international passengers in the year 1998. Traffic has grown by almost 100 % from the year 1994.

About 2 million passengers passed through the Vaalimaa and Vainikkala border crossings in the year 1998 (50 % more than in the year 1994). The share of passengers travelling by train has decreased: it was about 11 % as compared to 36 % in the year 1994.

Fast Pendolino trains were introduced in the railway traffic between Helsinki and Turku in the year

1996. The maximum cruising speed of these trains is about 200 km/h. The introduction of rapid railway traffic has clearly increased the number of passengers in the railway service between Helsinki and Turku. There were 0,79 million passengers between Helsinki and Karjaa in the year 1994, while there were 1,66 million passengers in the year 1998 (increase of over 100 %). The number of passengers was 1,09 million between Karjaa and Turku in the year 1998 having an increase of about 50 % from the year 1994. In road traffic, this amount of passengers equals to about 1300 private vehicles/day.

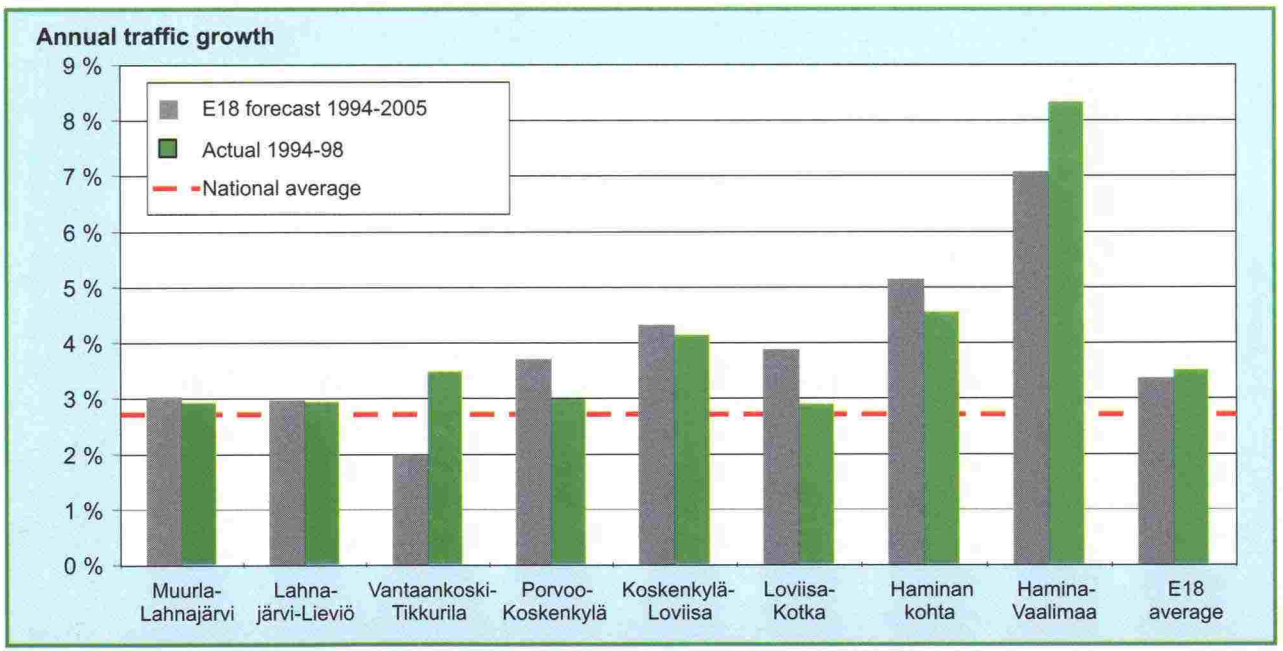
2.2 Traffic and its development on Road E 18

The greatest traffic volumes on Road E 18 can be found on Ring Road III in Vantaa, about 40 400 vehicles/day. The average daily traffic volume of the entire Road E 18 is now 12 100 vehicles. The average traffic volume between Turku and Hamina is 13 100 vehicles/day.

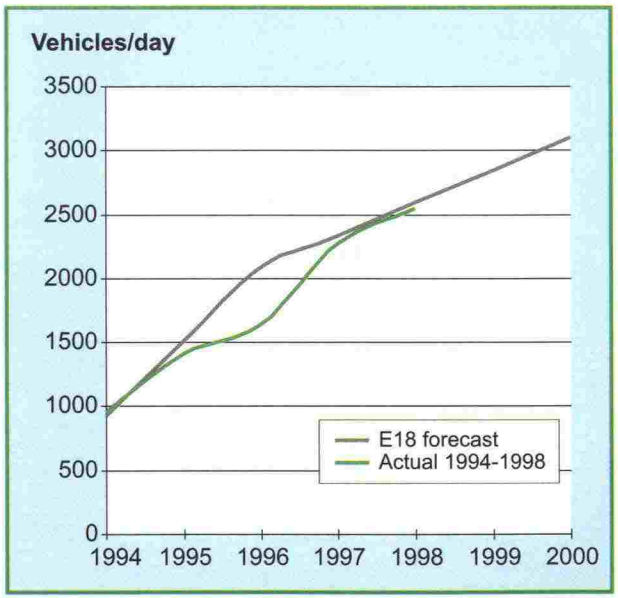
Traffic volumes on Road E 18 have so far developed accurately according to the forecast made in the Development Study. The greatest deviations from the forecast include the unexpectedly rapid increase in the traffic volumes on Ring Road III and on highway 7 between Hamina and Vaalimaa.

A forecast for the growth of traffic volumes crossing the border at Vaalimaa was also prepared in the Development Study. This forecast is very accurate when compared to the actual traffic volumes. The actual volumes in the year 1996 were lower than estimated due to the congestion at the customs station and diverting of traffic to other border stations. After the renewal of the customs station, the congestion was removed.

An average of 2500 vehicles/day crossed the border at Vaalimaa in the year 1998. The share of heavy traffic was less than 30 %. Transit traffic had a share of 54 % of heavy traffic. About 1300 vehicles/day passed through the ports of Turku and Naantali, heavy vehicles had a share of 30 %.



Development of traffic volumes on Road E 18 during the years 1994-1998



Development of traffic volumes at Vaalimaa border station during the years 1994-1998

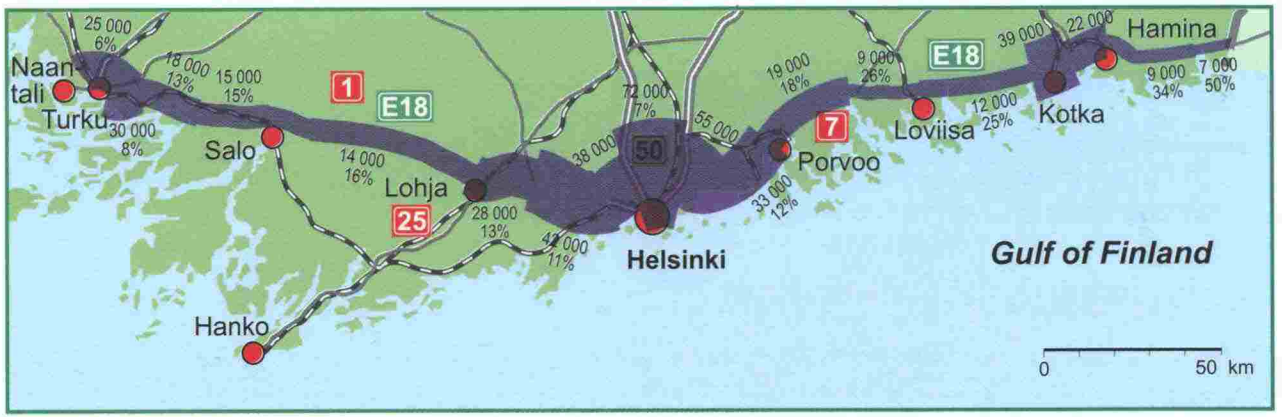
Traffic forecasts for the year 2020

New traffic forecasts for Road E 18 or its subprojects have not been prepared in this study. Traffic forecast information was collected from the plans of different road projects for the study on transport economics, which was conducted simultaneously with this study. Traffic volumes, which are presented in this page, are based on the results of this study.

The average daily traffic volume on the entire Road E 18 will be 18 100 vehicles in the year 2020. The rate of growth will be 50 % as compared to the existing volume. The average traffic volume between Turku and Hamina will be 19 400 vehicles/ day.

Traffic volumes crossing the eastern border have so far corresponded very accurately to the prepared forecasts. Traffic volumes decreased rapidly after the economic collapse in Russia in August of 1998. The development of traffic volumes will be monitored and traffic forecasts will be corrected, if needed. Traffic crossing the eastern border will have an impact only on the construction schedule of the easternmost part of Road E 18.

Traffic volumes on Road E 18 in the year 1998 (vehicles/ day)



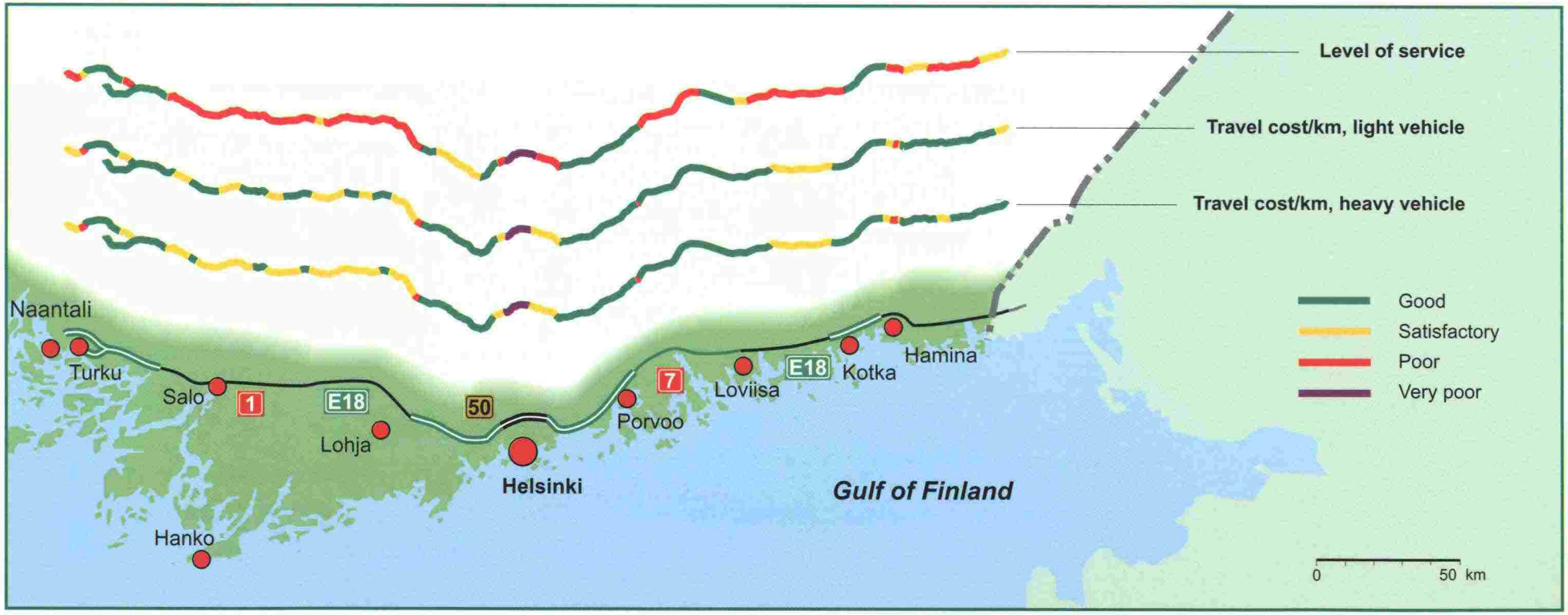
Traffic forecast for Road E 18 for the year 2020 (vehicles/ day)

3. PROBLEMS OF THE EXISTING ROAD

3.1 Technical problems of traffic

The technical problems of traffic and road were studied in the Development Study of Road E18. Since the year 1994, problems have been removed on road segments Turku - Paimio and Ring Road III between highway 1 - Vanhakartano, which have been constructed to a motorway, as well as on road segment Koskenkylä - Loviisa, which was opened as a semi-motorway in the autumn of 1998.

The remaining problems of the level of service exist on Ring Road III between Vanhakartano and Tikkurila as well as in Hamina and Salo. The fastest solution to the problem can be achieved in Salo where motorway construction between Paimio and Muurla is underway. The road segment will be completed in the year 2002.



Level of service and vehicle costs of the existing Road E18 with the estimated traffic load for the year 2005.

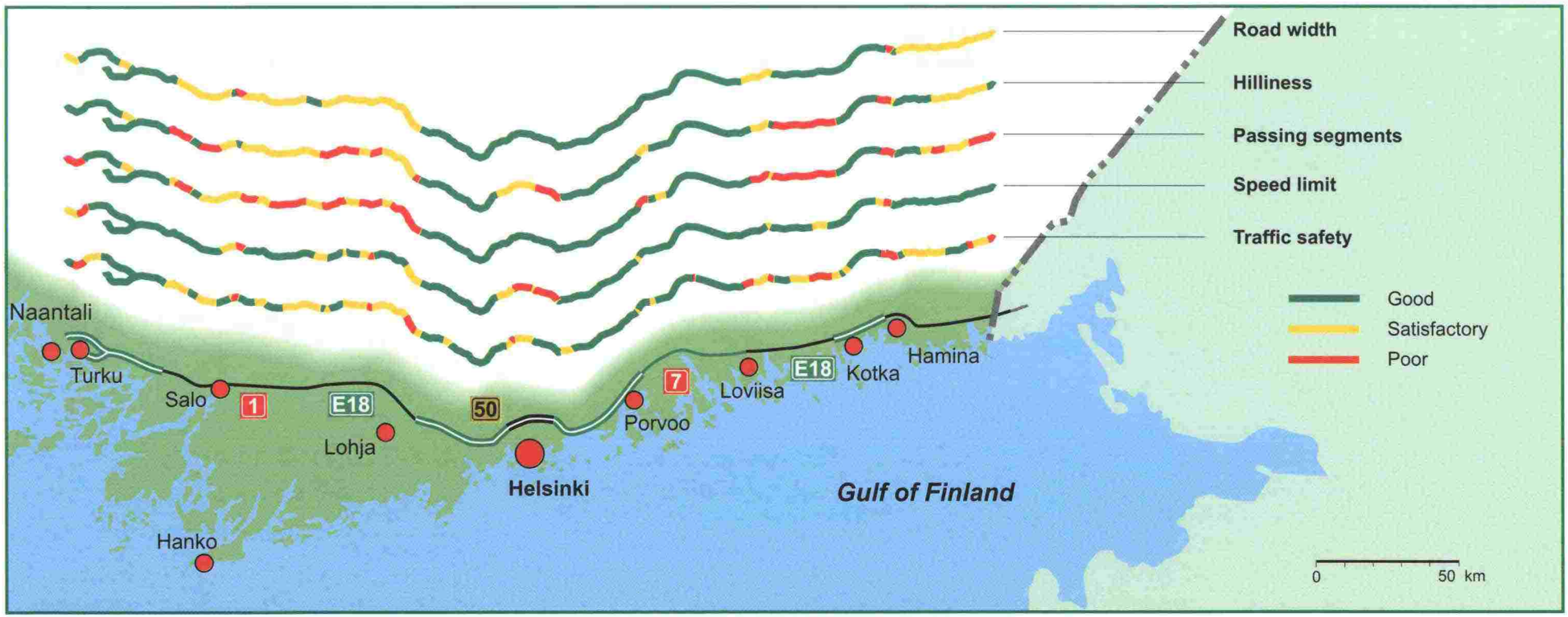
3.2 Technical problems of the road

The technical problems of Road E18, such as narrowness, hilliness, poor passing sight distance, speed level, vertical clearances of bridges and road structure concentrate on the old segments of mixed traffic. These include highway 7 between Loviisa and Kotka and city road segments e.g. at Salo and Hamina. Problems have mainly remained the same during the past four years.

Road E18 has many problematic segments for oversized transports. Some of these problems exist on the current two-lane segments, some of them on motorway segments. Low vertical clearances of bridges usually cause problems to oversized transports. These exist e.g. on Porvoo bypass road and at Kotka and Hamina. These segments will usually be avoided by making a detour using the minor road network or street network.

Currently, large and heavy transports going to Vaalimaa from e.g. the ports west of Kotka have to make a detour through Koskenkylä, Kouvola and Lappeenranta. This detour is about 270 kilometres, as the direct distance is about 65 kilometres.

Oversized transports will be considered in the planning of new roads. Some of the above mentioned problems will be solved when the new road segments of E18 will be implemented, but all restrictions on Road E18 cannot be removed.



Technical level of the existing E18 Road

3.3 Traffic safety

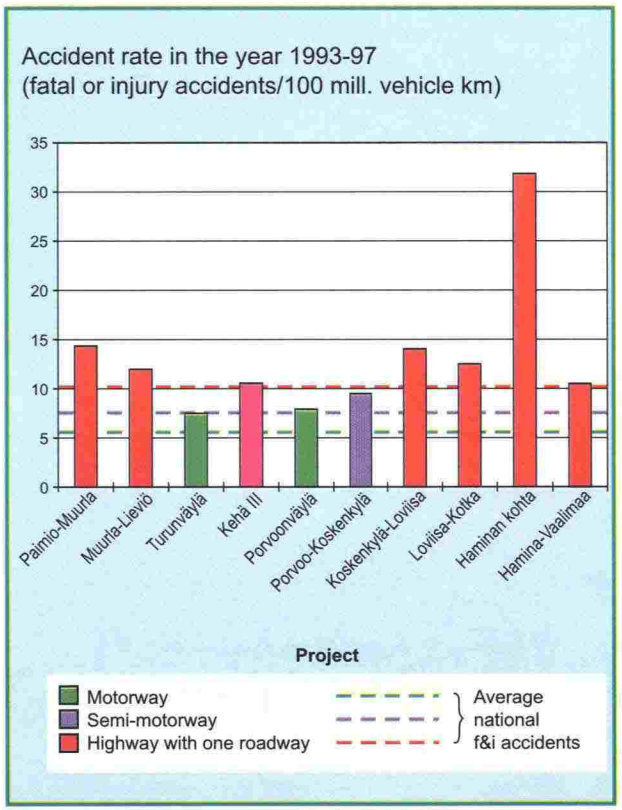
A separate study was prepared on the traffic safety of Road E 18 in the year 1996. The main results of the study confirmed the better safety level of motorway segments when compared to two-lane highways. It also showed a higher accident density (number of accidents per kilometres travelled) at Hamina when compared to other segments.

The share of accidents in winter is exceptionally high on some segments of Road E 18. One of these segments is highway 1 to the west of Hel-sinki. The technical problems of the road, such as curvature, contribute to these problems. Driving habits make the problem worse: drivers drive on the road like in good weather conditions. Sudden changes in weather conditions cause observation errors which easily lead to accidents. The traffic volumes on this segment are high and even small disturbances during peak periods may soon cause accidents.

Traffic safety on the easternmost segments of Road E 18 has been a problem which has also called for extensive discussion. The reasons have included the attitudes and skills of drivers in eastern traffic as well as the poor condition of vehicles.

This subject has been examined and several reports have been published on it. The latest one of them is the final report of the E 18 project "Towards better safety between Helsinki and Vaalimaa" by the provincial police management of southern Finland. It includes several suggestions for improving traffic safety. One of the most important suggestion is the improvement of Road E 18 at Hamina and between Loviisa and Kotka.

Poor traffic safety on highway 7 is regarded as a problem which causes insecurity. Thus, the rapid development of Road E 18 has been the main issue in the feedback from residents.



Accident densities on E 18 road segments in relation to national averages (1993-1997)

3.4 Environmental and other problems

In addition to transport economic profitability, also environmental arguments have been presented for supporting E 18 motorway projects. On the existing highways 1 and 7 as well as on Ring Road III, local residents and land use are disturbed by noise and other emissions, barrier effects and these road segments need ground water protection. Some separate plans and measures have been conducted for removing these environmental problems.

Problems of the existing road environment and measures for improvement have also been presented in the evaluations and plans for improvement possibilities of the existing transport network which form parts of the environmental impact assessment of E 18 subprojects. These problems should be solved equally with the new E 18 road projects in connection with the development of the parallel roads of forthcoming motorways.

Salting of **ground water** and the contamination risk caused by chemical accidents are some of the most serious existing environmental problems on Road E 18 corridor. The ground water protection on existing roads is insufficient and the need for ground water protection on existing road network is obvious. Efficient ground water protection has clearly decreased the chloride content of a water intake plant e.g. in Hagaböle (Pernaja, highway 7).

Noise caused by traffic is regarded as a significant problem having a negative effect on residential

comfort at many locations along the existing Road E 18. Currently, the most problematic locations on the existing road include the city centre of Salo, the communities of Suomusjärvi and Saukkola, Ring Road III, Pernajanlahti, Karhula and Hamina. The implementation of Road E 18 will considerably improve this situation, as other areas than Ring Road III and Pernajanlahti will be located along the old road.

The implementation of E 18 projects as a whole will reduce the number of people exposed to traffic noise, even if noise abatement measures are not considered. According to a study on this subject (Emission and Noise Impacts of Road E 18, 1996), the number of people disposed to noise will decrease by about 900 persons (21 %). The number of people living in a noise zone of over 65 dB will decrease by over 400 persons. The noise zone of the old E 18 road segment serving local traffic will become significantly smaller, as the traffic volumes and driving speeds will decrease. This development should, however, be monitored and noise abatement measures should be implemented along the old E 18 road segments, if needed.

Climatic change is generally considered as the greatest environmental hazard in the world. Traffic is the most important single source of emissions in the world which contribute to the warming of the climate. And even if the **emissions from the existing traffic** on Road E 18 do not exceed the standard values but stay under them also in the forecast situation, the greenhouse emissions will be even greater in the future due to general traffic growth. The increase in carbon dioxide emissions (CO_2) due to the growth in traffic volumes will promote the greenhouse effect and the climatic changes caused by it. According to estimates, the amount of other emissions than carbon dioxide will significantly decrease from the existing level with the development of technology. The amount of carbon dioxide emissions per vehicle kilometre will decrease. In the year 1997, the share of traffic of all CO_2 emissions was 20 % in Finland. About a half of it or 10 % was caused by private vehicle traffic.

The existing highway is considered as a land use **barrier** to the development of communities and city centres. Roads having heavy traffic, such as highway 1 in Salo and highway 7 in Hamina, are considered as functional barriers which reduce the level of comfort in these areas. This situation will change with the implementation of Road E 18, as the rapid, long distance traffic will move from the urban areas. The barrier effect between cities will be reduced by underpasses and junction arrangements.

The traffic volumes at the **Vaalimaa customs station** increased rapidly during the years 1994 and 1995 which caused congestion at the customs. Traffic was diverted to Nuijamaa which could also be seen in the traffic volumes of Vaalimaa in the year 1996. The customs station was expanded after which the problems were removed. The uncertainty about the timing of the implementation of the road as well as about the detailed alignment of the road will cause uncertainty also to the residents and business life of the impact area, will postpone development investments and, in the worst case, will lead to misdirected investments.

4. DEVELOPMENT OF THE IMMEDIATE IMPACT AREA OF ROAD E18 AND THE DEVELOPING OF ROAD E18

4.1 Objectives

The task of Road E18 is to support and enable the development of activities in its impact area as well as meet the traffic demand in a environmentally friendly, efficient and safe way. In this sense, the road has many roles which have already been described in the previous chapters. In terms of traffic volumes, the most important of these roles is to serve the immediate impact area of the road and to support its development. This role has been examined at the regional level by studying the development strategies of those regions which the road passes through as well as by examining the objectives that the Regional Councils have set to the development of the road. Visions about the development of the regional structure in Finland have also been presented at the national level (Ministry of the Environment 1995). The development of Road E18 also has a central role in supporting this vision.

In addition to the above mentioned general goals, some more detailed goals have been defined in the Development Study of 1995 and in other studies conducted after that. The implementation of these goals is examined in the following section. These goals included e.g.:

- Develop Road E18 according to the growth in demand to the level of the Trans-European Network (TEN) in the next 10-15 years which provides the road users with high, uniform and continuous service level, comfort and safety.
- Support the implementation of the development projects in the impact area of Road E18
- Active development of intermodal cooperation
- Preparation of a service network construction plan of different phases which is based on the growth in demand
- Considering of the special characteristics of the landscape of the areas in the planning and implementation of the project
- The task of the Road E18 environment is to express a "show window" of Finland in the future as well as to express Finnish architecture and design
- Modern experiments and applications of road and traffic technology as well as telematics will be applied to Road E18.

The implementation of these goals by subprojects and other development of different subjects have been described in the next chapter.

4.2 Road projects and construction

The development of Road E18 into a motorway between Turku and Vaalimaa includes eight road construction projects. Two of them can further be divided into subprojects.

Project 1 Turku-Paimio has been completed in the year 1997. The costs of the project were 928 million FIM.

Project 2 Paimio-Muurla includes a motorway construction from Paimio north of Salo to Muurla. The length of the segment is 35 kilometres and the cost estimate is 890 million FIM. The construction of the segment is underway and it will be completed in the year 2002.

Project 3 Muurla-Lohjanharju (Lieviö) includes a motorway construction from Muurla to Lohjanharju. The length of the segment is 60 kilometres and the cost estimate is 1960 million FIM. The project can be implemented in two phases: Muurla - Lohja and Lohja - Lohjanharju (Lieviö).

Project 4 Ring Road III includes the road improvement at the existing location. The project is divided into three phases in which the westernmost segment between highway 1 - Vanhakartano has been completed in the year 1997. The costs of the project were 290 million FIM.

The length of the segment Lentoasemantie - Tikkurila is 4 kilometres and the cost estimate is 450 million FIM.

The length of the segment Vanhakartano - Lentoasemantie is 7 kilometres and the cost estimate is 390 million FIM.

Project 5 Porvoo-Koskenkylä includes the full upgrading of the existing semi-motorway to motorway. The length of the segment is 25 kilometres and the cost estimate is 270 million FIM. The construction of the segment will start in the year 1999.

Project 6 Koskenkylä-Loviisa includes the full upgrading of the existing semi-motorway to motorway. The length of the segment is 15 kilometres and the cost estimate is 90 million FIM.

Project 7 Loviisa-Kotka includes the construction of a motorway from Loviisa to Kotka. The length of the segment is about 36 kilometres and the cost estimate is 700 million FIM.

Project 8 Hamina by-pass road includes the motorway construction by-passing the city centre of Hamina. The road has two alternatives. The final road alignment has not been selected yet. The cost estimates of the alternatives are 340-450 million FIM.

Project 9 Hamina-Vaalimaa includes a semi-motorway construction from the eastern side of Hamina to the Vaalimaa border crossing. The length of the segment is 30 kilometres and the cost estimate is 300 million FIM.

E18 road construction projects

4.3 Development of the immediate impact area of Road E18

The regional and community structure of southern Finland is still expected to develop so that the significance of growth centres and development corridors will be further emphasised. In the development view of the regional structure in Finland, the immediate impact area of Road E18 will be included in the category of urban zones and regions. The development of the Road E18 will support the above mentioned vision of the Ministry of the Environment.

The regions of Southwest Finland, Uusimaa, Eastern Uusimaa and Kymenlaakso are included in the immediate impact area of Road E18. A share of 38 % of the Finnish population or about 2,0 million people live in the immediate impact area consisting of four regions. According to the Statistics Finland (1998), the number of jobs in the area is about 820 000, a share of 42 % of the total number of jobs in Finland.

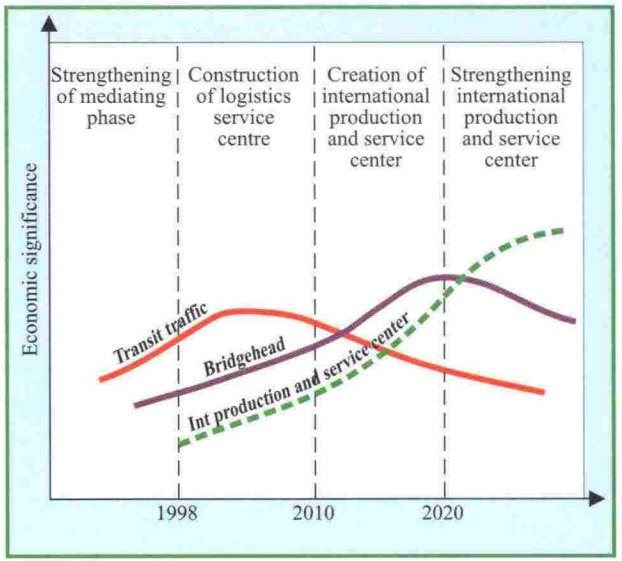
The coalition of the regions in southern Finland (the Regional Councils of Etelä-Karjala, Kanta-Häme, Eastern Uusimaa, Kymenlaakso, Päijät-Häme, Uusimaa and Southwest Finland) has published a Development Strategy of the southern Finland corridor in the year 1998, which provides a common view of southern Finland with regard to some of the most essential development projects of the region.

According to the vision outlined in the Development Strategy of southern Finland, the Baltic Sea region constitutes an economic area of its own

and southern Finland acts as a mediator between the east and the west in the sectors of politics, education, culture and economy. The phases of development are defined as follows:

- The base for the **transit route** or mediating phase is provided by a well-functioning infrastructure which is supported by versatile logistic, traffic and other services.
- The **bridgehead position** describes a situation in which the international companies operate from Finland to Russia and Scandinavia. The development is based on entrepreneurial services and the cooperation in the transfer of technology.
- In the **phase of integration**, southern Finland acts as a service and production centre providing international entrepreneurial services - a high quality business centre in the Baltic Sea region.

The location as well as the well operating and safe connections are regarded as the most significant competitive advantage of the southern Finland corridor. The corridor is the nearest western Gateway area to Russia. The area is the only western mediator for sea transports and has a direct access to the Russian railway network. This provides a direct access by truck transport to the entire northwestern Russia, Belorussia and the Baltic countries. The area has good connections to the Nordic countries and central Europe. Well-functioning transport services and high quality logistic services constitute a benefit as compared to the other Gateway areas around the Baltic Sea.



Phases of the gateway strategy

In addition to transport networks, the know-how in logistics is regarded as the second essential strength of the Gateway competitivity.

The goals of improving the transport connections include the acceleration of passenger traffic, more efficient freight traffic, the improvement and development of telecommunications, the introduction of new financing methods for infrastructure investments, the development and marketing of logistic services and promoting of the networking of different modes of transport.

The Development Strategy of southern Finland corridor focuses on the top projects of infrastructure. Six infrastructure projects have been classified as strategic projects. The first one of them is European Road E18. The other top projects include railway connection Turku - Helsinki - Lah-ti - St. Petersburg, the port of Vuosaari in the Helsinki Metropolitan Area and the development of the ports in southern Finland, the development of the Helsinki-Vantaa airport, securing of the ferry operations in the sea traffic between Finland and Sweden (Nordic Triangle/E18) and the development of transport and delivery systems with the aid of telematics. These projects will strengthen the position of southern Finland in the Baltic Sea region and will support the development of southern Finland as one common economic area.

Road E18 is a central project in the development programmes of the regions. The following describes the most significant development projects of southern Finland by region.

In the development programme of the **Southwest Finland** region, which was completed in the year 1994, the first emphasis was the Meeting Point between the east and the west. The emphasis included the goal of developing the region as a gate between the east and the west as well as to provide for the necessary interaction networks. Transport projects, such as Road E18, the electrification Helsinki-Turku railway and the Pendolino railway service, have had the best progress of the projects which were planned at that time. The mediator position of Southwest Finland between the east and the west has recently been changing, as the connections from other countries to Russia have increased and the transport connections between Russia and other Europe have improved.

In the regional development programme of Southwest Finland of 1997, more extensive development and research projects with regard to their content and area will be sought to replace the previously important thinking based on significant transport connections and relations to the east.

Southwest Finland aims at developing to a centre of the Baltic Sea region which specialises in environmental, health and technological questions. The improvement of insufficient transport connections and removing of bottlenecks are regarded as the central preconditions for the competitiveness of Southwest Finland. The essential goals for Southwest Finland in constructing the network include traffic safety and the principles of sustainable development as well as international connections to Sweden, the other parts of Scandinavia, the Baltic countries and the European continent together with the connections to Russia through the region. The nature of land use planning will be changing when moving from the construction of new areas to completing of the existing community structure. A uniform commuting area is developing between Turku and Salo.

The goal of **Uusimaa** is to develop the region to an attractive, growing European economic area. In the economic policy, scientific parks, such as Innopoli, Viikki, Arabianranta and Biomedicum, will have a significant role in the development of the economic activity based on the quality growth of the development strategy. Land use and the location of activities will be guided to support the operational conditions of the strong sectors of production based on extensive know-how. The Uusimaa knowledge centre by the Uusimaa Regional Council is a significant project which supports the economic development.

Uusimaa is regarded as the forerunner in national economy serving as a wide and multicentered commuting area. An annual increase of about 12 000 - 15 000 residents will be prepared for in zoning. Part of this population growth will be directed to the fringe areas of the region through the development of economic life and supporting economic measures. About 2/3 of the growth will be directed to the Helsinki Metropolitan Area. The regional structure of Uusimaa will be developed by completing of the existing structure.

The construction of Road E18, moving of the main parts of the port of Helsinki to Vuosaari and improving of the railway connections to St. Petersburg are included in the development strategy of infrastructure. The first phase would include the construction of the direct railway line to Lahti. Furthermore, the programme includes the third runway, which is under construction, as well as improving of the terminals and ground transport connections at the Helsinki-Vantaa airport. The development of the airport and the ground transport connections constitute a central part of the development work of the Uusimaa logistics centre. One of the most essential improvements is the construction of a railway connection to the airport area.

The Ring Road III area in the Helsinki Metropolitan Area is the focus for work place development where the good logistic location of the area is used for attracting business activities. The city seeks to attract productive business activities to the area and attempts to promote network-type of structures between companies in e.g. locational questions. The city also wishes to provide the economic life with the infrastructure of a modern information society.

In **Eastern Uusimaa**, the mediator position and Road E18 will be utilised more and more for the benefit of the region and for strengthening the position of the region as an international actor. The precondition for the development is a functioning transport and other infrastructure and its development.

Eastern Uusimaa is the most industrialised region in the country and the strong sectors of production include energy production, chemical and electrotechnical industry as well as tourism. Most of the development projects concentrate on the impact area of Road E 18. It is regarded that Road E 18 will provide excellent opportunities for the supply of high quality tourist and entrepreneurial services.

The improvement of the level of service and attraction of Road E 18 are included in the top projects of the region. The port of Sköldvik, which is the largest port of the region and the country, serves the chemical industry of the area. The port of Loviisa has specialised in the transports of bulk goods.

According to the central content of the development programme of **Kymenlaakso**, the region

has shifted from its gateway position between the east and the west of the early 1990s to a versatile centre of international production and services. The central factors in this change include adequate logistic services and the significant improvement of the know-how required by an information society.

As the transports of bulk goods will decrease in the ports of Kymenlaakso, the transports of containers and valuable goods will increase. The region has come up with a start in the bridgehead position; international companies are locating in Kymenlaakso. The region is shifting from managing of only transit traffic to a versatile centre of logistic services.

Many bottlenecks, such as the customs and border crossing arrangements and retail services at Vaalimaa as well as the construction of container terminals and warehouses, have been removed in road, railway and sea traffic in Kymenlaakso during the years 1994-97. The smooth road traffic and border crossing operations at Vaalimaa have been disturbed by the unexpected licenses and charges imposed by the Russian authorities. The situation at the customs has now returned to normal.

The logistics programme by the Chamber of Commerce in Kymenlaakso, which was prepared in the year 1998, concentrates on the analysis of the existing situation and the identification of the factors of success as well as the proposals for action of logistics which is the central sector of production for the future development of the region. The share of jobs in logistic services was 8,5 % of the total number of jobs in Kymenlaakso in the year 1996. Logistics is a growing and strengthening sector of production in Kymenlaakso. In addition to the income from companies, logistic services also provide the region with public sector income through port charges, taxes and new jobs.

4.4 Roadside services and fixtures

There have been only minor changes in **roadside services** in recent years. This is mainly due to the fact that new road segments have only been opened to traffic between Turku - Paimio and Koskenkylä - Loviisa.

Entirely new rest areas on Road E 18 since the year 1994 have been opened at Sarvilahti in Loviisa and at Makarla in Piikkiö. The only new service area is at Tammisilta in Paimio.

A study "Development of E 18 Planning Principles" was prepared in the year 1996 for harmonising the planning of Road E 18. It included the guidelines for the planning of road milieu, traffic control and roadside services. Turku and Uusimaa Road Districts have prepared analyses on the existing services on Road E 18.

A guideline "Parking and Rest Areas" was completed in the year 1997. It focuses on the questions of improving the level of service of rest areas and provides examples of alternative solutions.

There is a shortage of rest areas along Ring Road III. Heavy traffic would especially need more parking possibilities in the area. The need is partly based on the legislation controlling working hours which changed in the year 1996. The new legislation requires that drivers should take refreshment brakes more often.

Telematics in road traffic has been strongly developed. The Finnish National Road Administration implemented an experimental programme in telematics on Road E 18 during the years 1996-1998. New solutions based on telematics were studied and developed in almost 50 projects for improving the safety and smooth traffic operations as well as driving comfort.

The impacts and benefits of transport telematics as well as the possibilities for extending the use of telematics to the whole country were examined in the experiment. The central parts of the experiment included data collection, data management, data transfer and traffic control as well as impact assessment. Some of the experimental projects were also part of the European research projects on telematics.

During the experiment, the road weather station network was extended by new types of weather stations and a prototype of a mobile observation station was developed to support weather observations. Digital image processing was found to be a promising traffic counting method for the real-time observation of traffic volumes.

Preparations have been made for the introduction of the new European radio traffic information channel RDS-TMC (Radio Data System - Traffic Message Channel) in southern Finland. In this system, traffic information can directly be trans-

mitted to the display units in vehicles. Real-time traffic information was concentrated on its own home page in the internet (www.tieh.fi/alk). Internet was also used when experimenting with traffic data transmission to GSM-phones and traffic information points.

The adjustment of driving speeds based on weather conditions is in use between Pyhtää and Hamina and between Lohjanharju and Salo. The use of automatic, variable speed limit signs based on weather conditions are supported by variable traffic signs which provide information on the weather conditions of the road. The impacts of variable speed limits based on road and traffic conditions, on traffic safety and smooth traffic operations have been favourable.

The adoption of variable speed limits on the main roads in Finland has been examined based on the results obtained from the experiment area on Road E18. However, there is no adequate information yet on the impacts of variable speed limits in different types of areas. Extending of the system to the main road network with largest traffic volumes will be considered.

Automatic moose observation and moose warnings through variable moose warning signs are experimented with on the Porvoo motorway. The worse the road conditions were, the greater the effect of the signs was on driving speeds.

A cooperation project of the Interreg II C programme is being conducted on Road E18 corridor. A part of this project is to create an adequate information network for the area. The goal of the internet service created in the project is to cover the municipalities of the road corridor as well as the retail services and tourist sights of the area. The project will be completed in the year 2001. The other parts of the project deal with the special questions of land use and transport in E18 corridor.

4.5 Landscape and road environment

Previously set goals and themes of road architecture for the Road E18

Goals have been set as well as visions and ideas have been developed for the road architecture of E18 in different context in recent years.

The goals of the report regarding the development of E18 road environment (Development of E18 Planning Principles, Road Milieu, Studies of the Finnish National Road Administration 54/1996) included

- perception of the Finnish cultural landscape by the road user
- highlighting of the international European Road visually using Finnish design
- best possible adaptation of road structures to the immediate environment

The methods and ideas included the following. The adaptation of road geometry to the immediate environment in a way that unobstructed views of the cultural landscape of southern Finland will be provided for the road user.

A harmonised design of road fixtures and structures expressing the Finnish style of design was recommended for the symbols of the visual look of the Road E18. Also, the use of identifying colours - blue-green shades - in structures was recommended.

Light was recommended to be used for highlighting optical guidance. Furthermore, the use of a new kilometre pole with identifying colours at 5 kilometre intervals was recommended. The rest areas were proposed to be developed to higher quality using architectural methods and structures to express the public image of Road E18. Similarly, the improvement of bus stop fixtures together with the use of harmonised architectural style was recommended.

Another report "E18 Road Architecture" (Turku Road District, 1995) dealing with the development of the image of the western part of the road, emphasised the importance of the good harmonisation of the road and cultural landscape as well as providing unobstructed views for the users. In addition, the importance of the full image of the road was presented in the report. The methods included the highlighting of the elements showing visual shape, such as bridges and rock cuttings, using architectural, artistic and lighting methods.

In addition to these projects dealing with the general development of E18 road architecture, a visionary recommendation for the development of the road architecture has been prepared on the segment in the Metropolitan Area, Ring Road III. It recommends the application of the principles included in the report on the E18 road environ-

ment with urban emphasis on the road segment in the Metropolitan Area.

Especially, the design of traffic control fixtures in a harmonised way as well as uniform themes for the architecture of bridges and noise barriers are recommended. Lighting should highlight optical guidance and the identity of locations, for example bridges as gate themes.

Implementation of road architecture in recent road improvement projects on Road E 18

Some segments and targets have been recently improved on Road E 18. The projects have been independent construction projects in different Road Districts, in which the goals of the E 18 road architecture have been occasionally implemented. The only comprehensive development project has been the product development of the kilometre pole by professor Antti Nurmesniemi. This kilometre pole is in experimental use between Kotka and Hamina.

The architectural goals set for the road have not been significantly developed or implemented on the Turku - Paimio road segment. The reason for this is the long time span of road engineering: planning was already underway when the planning principles of Road E 18 were published. High environmental quality on this segment was provided by using the methods of environmental construction.

The interchange area of Turunväylä and Ring Road III was implemented as a gate between the international Road E 18 and the Helsinki Metropolitan Area. The interchange was designed in a vast landscape space with smooth road alignments, noise walls and guardrails as well as bridges. The power line poles located in the middle of the interchange were designed as an environmental work of art ("Blue Cranes") expressing the entrance point. The identifying colour of Road E 18 was applied to the work of art, bridge and noise barriers.

Architectural features can be seen in bridges (pillar forms, terraced inner slopes, guardrails) and in the plastic forms of noise walls on Ring Road III segment of Road E 18 between Turunväylä interchange and Vanhakartano. These features do not have the characteristics of E 18 road architecture but the special guardrail is also used in other sites in the vicinity.

A high quality rest area has been planned in Sarvilahti which is located on the implemented segment between Koskenkylä - Loviisa on the eastern part of the road.

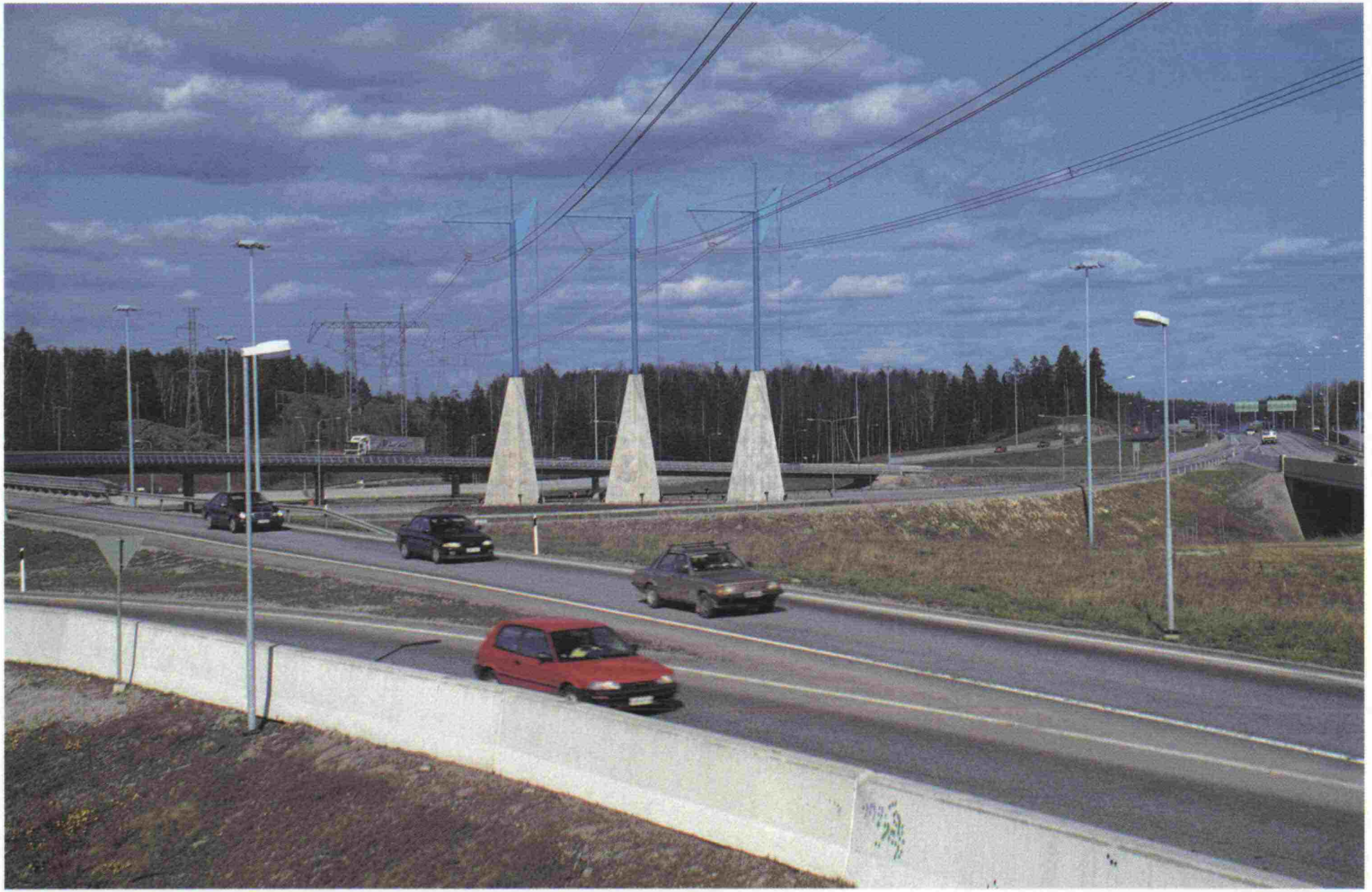
Characteristics of E 18 road architecture presented in plans

Meeting of the goals of E 18 road architecture can be seen in some of the recent plans.

A final road engineering plan has been prepared for Ring Road III between Vantaankoski - Tikkurila. An architectural classification of bridges and environmental fixtures based on environmental value as well as recommendations for architectural characteristics have been prepared for this segment. Similarly, a recommendation for the architectural characteristics of road fixtures and equipment has been prepared. The themes are based on the development plans of E 18 road environment. The guidelines and need for architectural planning as well as the principles of using colours are specified in the plans.

A final road engineering plan has been prepared for highway 1 between Lohja and Lohjanharju together with the plans for improving the entrance road to Lohja. Furthermore, a competition for obtaining ideas of improving the preliminary road engineering plan has been arranged on the road segment Karnainen - Lahnajärvi. In these plans, the adaptation of the road to the valuable cultural and natural environment has carefully been studied so that the road is user-friendly, beautiful and causes as little disturbance as possible. These goals support well the development principle of Road E 18.

The identifying colour of E 18 is repeated on the bridge and noise barrier structures of the road. In addition, it has been proposed that the gate locations of the entrance road in Lohja should be highlighted by using light earth material from Lohja in supporting environmental structures and as processed concrete in the architectural themes of bridges.



4.6 Intermodal cooperation

Intermodal cooperation in **passenger traffic** includes the improvement of smooth traffic operations on the entire trip chain and especially good opportunities to transfer to another mode, for example from car to train or bus. For the planning and implementation of Road E 18, this includes good connections to terminals, guidance and transfer possibilities at the most important bus stops.

A park & ride experiment is underway in the Helsinki Metropolitan Area, in which parking space has been reserved in railway stations along all main entrance roads. Drivers, who have their destination in the city centre, can leave their car at the stations and continue their journey by train. The system will still be developed. Related to the system, there is e.g. a variable guide sign system on highway 1 which provides the departure times of trains and buses to the Helsinki city centre.

Road E 18 is a central part of the logistics system of southern Finland. In order to provide for a well-functioning system, it requires, in addition to uncongested and safe road, good connections and guidance to the ports and stations. The combined transports in **freight traffic** include ship-truck, ship-train and truck-train transports.

The services provided to the drivers have not significantly changed in recent years. More rest area services are needed especially on Ring Road III.

4.7 Guidance

Several improvements with regard to guidance were presented in the planning principles prepared for Road E 18. The innovations concerned the motorway segments of Road E 18.

The first traffic signs on Road E 18, which were implemented based on the planning principles, were the distance signs, in which St. Petersburg was included as a long-distance destination. Now there are about 20 distance signs of this kind along the road. Positive feedback with regard to the guide signs has been received from the road users.

It was suggested in the planning principles that all interchanges would be numbered. This system will make guidance and route information significantly easier. The planning for implementing this system will start in the year 1999.

"Kilometre poles" at five kilometre intervals have also been planned for Road E 18, which in addition to the number of the road, also include distance to the next long-distance destination. These poles have been experimented with in the Kotka region.

Guide signs with brown background are used for the guidance to historical and landscape sights as well as to other valuable sights which can be observed from the road. Signs of this kind are used in several European countries, e.g. in France and Great Britain. Currently, the historical Kuninkaantie is guided with signs having brown background. Other sights with similar signs are being considered.

5. IMPACTS

5.1 Impacts of traffic and transport economics

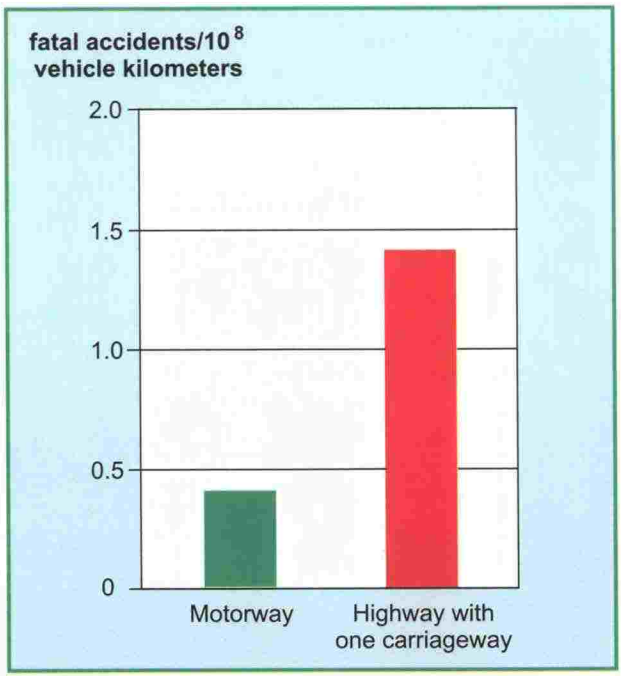
The most important **traffic impacts** of the implementation of Road E18 include the alleviation of congestion on the road, decrease in travel times and their variation as well as the improvement of traffic safety.

A road operating near its capacity is very sensitive to disturbances. Poor weather conditions can only cause road congestion which will significantly slow down traffic even for many hours. Road E18 serves the most important passenger and freight terminals in the country. Therefore, decreasing of the road's sensitivity to disturbances is very important.

Without the implementation of the motorway, the capacity of Road E18 would be exceeded at many locations in the forecast year, which would cause frequent congestion and related increase in operating, time and accident costs.

Motorway is by far the best road type with regard to traffic safety. For example, the number of fatal accidents per a kilometre travelled is 3,5 times higher on regular two-lane highways than on motorways. The significant difference is due to the separation of oncoming traffic to its own carriageway and the non-existence of intersecting traffic. For example, due to the implementation of the segment Muurla - Lohjanharju of Road E18, the estimated number of fatalitiess will be reduced by about 50 and the number of injured persons by about 480 in the road network of the impact area during the following ten years.

The development of Road E18 consists of subprojects. Their impacts and profitability vary. In this context, the profitability of those projects have been studied, the construction of which have not been started yet. Studies have been conducted based on identical arguments and methods. The **transport economic impact assessment** of the projects is based on the analyses made with the IVAR-computer programme developed by the Finnish National Road Administration. This method will estimate the benefits more carefully than many other methods. The IVAR-analyses have been supplemented, as far as heavily loaded junctions and network impacts are concerned.



Accident rates on different road types

In city areas, the impacts of projects mainly consist of the removal of congestion and accidents at traffic signals and junctions, while outside of the city areas they consist of the improvements in the level of service and traffic safety. The projects also cause changes in traffic volumes both locally and in larger area.

The profitability estimates of projects will often be specified only at the end of the planning process when the solutions and investments will finally be decided on. The profitability of sub-projects will also depend on the construction time period and duration of projects.

The total profitability of E18 subprojects will be about 1,4 - 1,6 for the estimated projects depending on e.g. the timing of the construction, type of financing and final solutions.

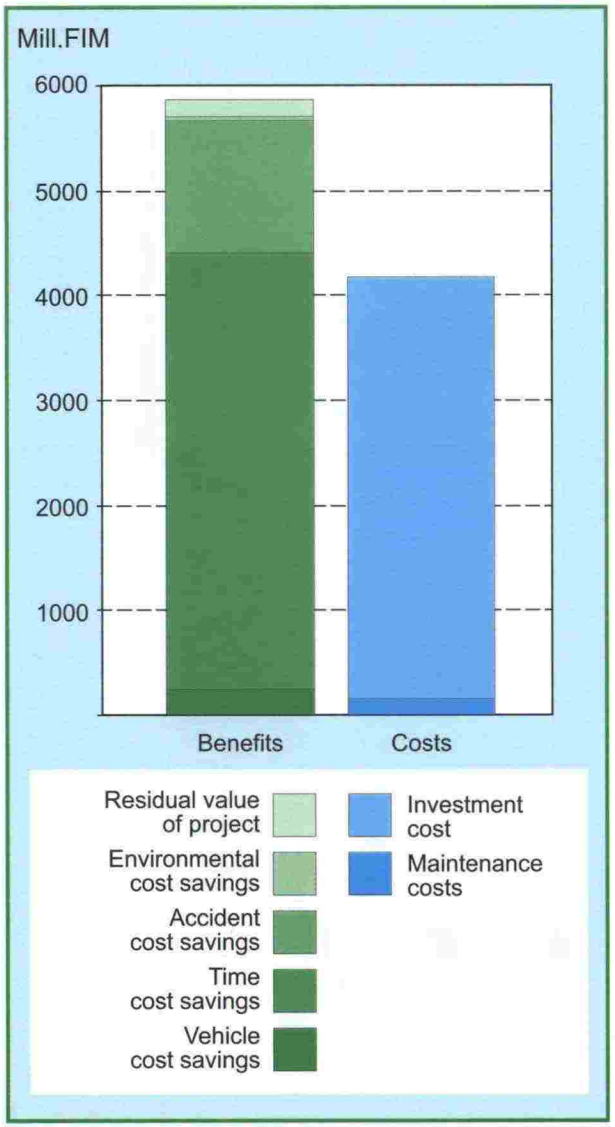
Muurla-Lohja-Lohjanharju (Lieviö) segment includes two phases. In the first phase, a motorway will be constructed from Lieviö in Lohjanharju to Lohja and in subsequent phase from Lohja further on to Muurla through Lahnajärvi.

The first implementation phase will solve the problems on highway 25. The road will have significant capacity problems in the future especially at signalised at-grade junctions. The large number of

junctions also decrease traffic safety. The construction of a motorway from Lieviö to Lohja will remove these problems but the profitability of the first phase will be decreased due to longer alignment of the new road compared to the existing road, which has been planned for the final situation. The benefit-cost ratio of the first construction phase will be between 1,5 - 2 depending on e.g. the construction time period and duration. A share of about 90 % of the savings will consist of time cost savings and about 10 % of accident cost savings. A share of over one-fourth of the savings will consist of cost savings at junctions.

In the second phase, the motorway will be continued from Lohja through Lahnajärvi to Muurla from where a continuous motorway leads to Turku. The construction of the second phase will move the traffic of highway 1 to a new land corridor and will create a new connection from the Lohja region towards Turku. The new connection will divert traffic to the new road locally and from larger area. The benefit-cost ratio of the second phase will be about 1,1 depending on e.g. the construction time period and duration. An exceptionally large share of the savings, almost a half, will consist of accident cost savings. A share of about 20 % of the savings will consist of savings created on the road segments and 10 % will consist of extensive network impacts.

Ring Road III between Vantaankoski-Tikkurila consists of two parts. In the first phase, Ring Road III will be improved between Lentoasemantie-Tikkurila and later between Vantaankoski-Pakkala. Most of the traffic on Ring Road III consists of internal traffic within the Helsinki Metropolitan Area.



Distribution of benefits and costs of the Road E 18

The impacts of the project will mainly be based on the benefits of improving the overloaded, signalised junctions on the road segments. The improvement of Ring Road III will also assign traffic to it from the other orbital connections of the Helsinki Metropolitan Area. A major part of the benefits will consist of time cost benefits. The benefit-cost ratio of both phases of the project will be 2,5 - 3 depending on e.g. the timing of the project as well as the development of transport system and land use in the Helsinki Metropolitan Area.

Based on the preliminary road engineering plan, the construction of a motorway for the **Loviisa-Kotka** road segment will replace the existing road. A major part of the benefits of the project will consist of time and accident cost savings on the road segments. The benefit-cost ratio of the project will be around 1 depending on e.g. the construction time period and selected alignment of the project. The profitability of the project as a motorway will not be very high due to the relatively small traffic volumes on the existing road and due to high construction costs.

In connection with the Loviisa-Kotka project, also the **Koskenkylä-Loviisa** segment will be upgraded from semi-motorway to motorway. As the traffic volumes on the existing road are quite small, the benefit-cost ratio of constructing another carriageway will be about 1 despite the inexpensive construction costs. The benefits will consist of time and accident cost savings.

The congestion of the street network, traffic safety and environmental problems will increase

the operating, time and accident costs of the existing road **at Hamina**. There is no decision on the alignment of the road. There are two road alternatives, a tunnel passing under the city centre of Hamina and an alignment passing the city centre on the northern side. A draft of the regional plan is being prepared by the Kymenlaakso Regional Council based on the northern road alignment.

The traffic load on the **Hamina-Vaalimaa** segment will approach the capacity of the existing road significantly later than for the other subprojects. The principal solution has not been selected or planned yet and thus there is no base for adequate estimation of the profitability. According to preliminary estimates, the project would consist of constructing a semi-motorway parallel to the existing road. Afterwards, it is possible to upgrade the semi-motorway to motorway.

The projects can be divided into two groups based on the preparedness in planning and profitability of the road segments. There is no opinion on the internal rank of projects within the groups, as the differences in profitability are not significant, and as the financing possibilities will significantly affect the time schedule.

Based on the profitability study, the most urgent projects include segments Ring Road III, E 18 at Hamina and Muurla - Lohjanharju (Lieviö) Of these projects, however, the implementation of Hamina by-pass will be postponed, as there are no required decisions on the road alignment.

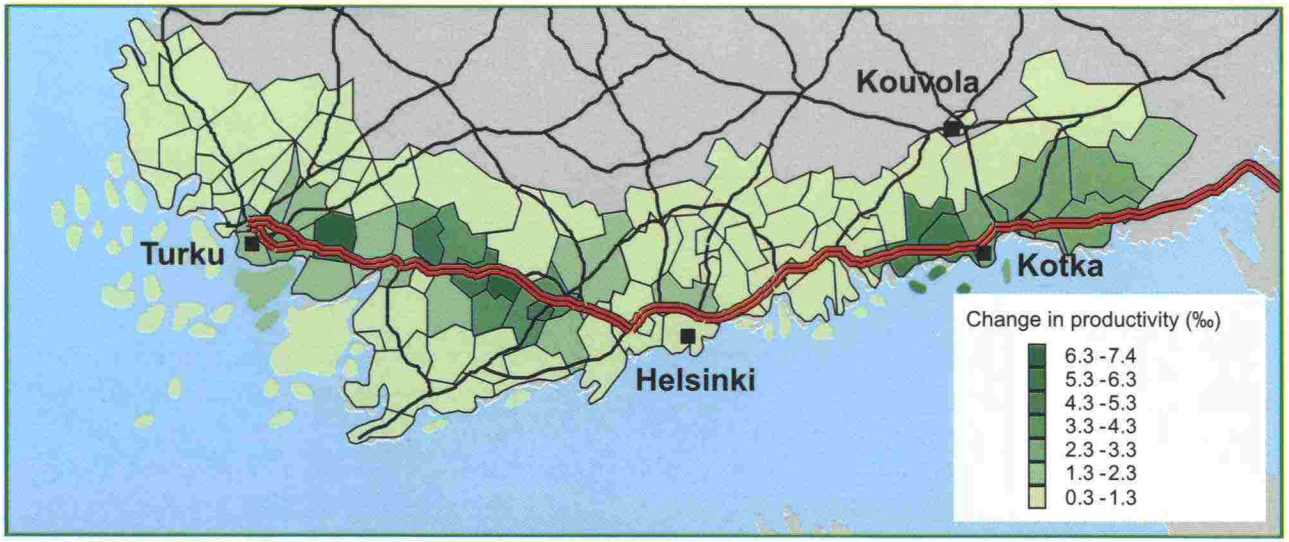
The profitability of other road segments, Muurla - Lohja, Koskenkylä - Loviisa and Hamina - Vaalimaa, is lower. The construction of Hamina - Vaalimaa connection will depend on the development of Russian traffic. The profitability of other road segments will significantly depend on the construction time period and financing method. In addition to profitability, the corridor effect caused by the common standard between Turku - Helsinki and Helsinki - Hamina should be taken into consideration. This effect, which is especially emphasised by the Regional Councils together, will create feasible preconditions for the location of business life along the road corridor, will promote their productivity and competitiveness, will expand their market areas, will improve the attraction of labour force and will promote networking. The above mentioned factors will mainly be left out of the transport economic profitability study.

5.2 Impacts at the national, regional and municipal level

At present, a significant migratory flow is directed to the southern part of Finland and thus also to the E 18 area. Migration has been greater only in the early 1970s when employment from agriculture moved to cities creating a great migratory flow. This flow followed the great migratory flow to Sweden during the years 1969-70.

Comprehensive and extensive material was compiled in the Development Study of Road E 18 for analysing the impacts of the project on regional economy. Now, they were also used for analysing the impacts of migration.

The results are very distinct. As it was presented in the E 18 Development Study, the greatest regional economic benefits will be distributed to the "su-



Magnitude of the increase in productivity in municipalities

perseded" municipalities which, based on the analysis, have a low level of urbanisation and education as well as poor accessibility. Net migration will, however, be directed to municipalities which have good accessibility and high level of urbanisation. These municipalities are usually large and have high productivity or high turnover per person. The absolute benefits will be the greatest in these municipalities, although their relative significance will remain low.

Relatively, the greatest benefits of Road E 18 are allocated to those fringe areas which are located between the existing municipalities and areas having a positive migratory balance. At the moment, these benefits are so small that they will not balance for the regional allocation of in-migration within the impact area of Road E 18. This development can, however, be expected in small scale in the long run. Then, the peak of the existing migratory flow will be passed.

Migration will also promote greater differences in education between the origins and destinations. The situation would be very poor without regional universities. University cities attract young people with education or in need for education. Educated people will then move from the university cities to their impact areas. The strengthening of this effect could be regarded as an efficient regional policy. The negative effects of this kind of regional policy would, however, include the increase in the kilometres travelled, while the positive effects would consist of the declining need for construction in those areas with negative migratory balance.

5.3 Environmental impacts

Implementation of EIA in E 18 projects

The EIA Act or Act on the Environmental Impact Assessment Procedure was enacted in the year 1994. The Act requires that an environmental impact assessment is conducted on motorway and semi-motorway projects. There are a total of seven legal environmental impact assessments of motorway projects related to Road E 18 during the years 1994-1999:

- highway 1 Paimio - Muurla (Turku Road District 1995)
- highway 1 Lohja - Salo (Uusimaa Road District 1996)
- improving of Ring Road III (hwy 50) between Vantaankoski - Tikkurila (Uusimaa Road District 1997)
- highway 7 Porvoo (Harabacka) - Koskenkylä (Uusimaa Road District 1996)
- highway 7 Koskenkylä - Loviisa (Uusimaa Road District 1992-1994)
- highway 7 Loviisa - Kotka (Kaakkois-Suomi Road District 1997)
- highway 7 at Hamina (Kaakkois-Suomi Road District 1996)

Every EIA has included:

- preparation of the assessment programme and the statements issued by the coordination authorities
- arrangement of the public hearings
- impact assessment and comparing of alternatives
- preparation of the assessment report and statements issued by the coordination authorities.

According to the EIA-process, the coordination authorities have been the Regional Environment Institutes i.e. the Environment Institutes of Southwest Finland, Uusimaa and Southeast Finland.

Most significant environmental impacts of E 18 projects

In the seven EIAs related to the planning of Road E 18, the most essential and significant environmental impacts have all concerned the environmental sectors specified in the EIA Act. The following describes the most significant and the most frequent or the most essential impacts.

Noise

The construction of new motorway alignments will expand noise problems to residential areas and valuable natural sites where these problems do not exist yet. Although the noise abatement structures constructed to the new roads mitigate this problem, noise abatement on the existing roads, such as highway 1 and Ring Road III, is also needed.

Cultural landscape and historical sites

The construction of a motorway through the valuable entities of cultural landscape will cause changes to landscape, e.g. in Halikonjoki valley, Uskelanjoki valley, Ruotsala, Kruusila, Laperla and Kymijoki valley.

Vegetation, fauna and the diversity of nature

Several natural sites are destroyed by the motorway or the road is aligned in their vicinity so that the protective value of the sites will be threatened. These sites are located e.g. in the Sammatti - Nummi-Pusula lake highlands and Lohjanharju as well as in the bird community of Pernajanlahti (Natura 2000 sites) and the forest area of Röisuo. Motorway also constitutes a barrier for the movement of moose and other animals. This problem will be mitigated by e.g. constructing ecocorridors and underpasses for animals.

Land use development

The reduction of the barrier effect on the existing highways 1 and 7 due to the construction of a new motorway is considered as a positive environmental change for example in Salo. Some of the smaller communities along highway 1 have expressed their concern about the decline of services in built-up areas along the road and the isolation of villages.

Protecting of the quality of ground water

Ground water protection is constructed along with the construction of new motorways and semi-motorways. If the transports of hazardous goods are assigned to these roads, the quality of ground water can be protected. Risky transports and road salting will still remain on the existing roads which constitute an environmental risk. The problem with salting has been identified and it will be considered in planning in the ground water areas.

Citizen participation in E 18 EIA projects

One significant impact of EIA has been the organisation of citizen participation. Interactive planning has improved the quality of plans and promoted the acceptance of the construction of new roads.

Also, critical feedback from citizens have been received in EIA projects. The improvement of existing network and its development as an equal and potential alternative has been emphasised in the feedback. This will cause a problematic comparison framework due to the fact that EIA is conducted in a phase when the planning of a new road alignment has already been decided on based on a feasibility study.

Mitigation measures of adverse effects

Mitigation measures of adverse environmental effects have been presented in the plans of E 18 motorways and semi-motorways and in EIA reports with regard to those adverse effects, which can be affected in the technical planning of the roads. Part of the adverse environmental effects have been mitigated by using these measures.

The EIA-process itself has clearly promoted positive environmental attitudes towards the plans of E 18. This can be seen in the introduction of new alternatives for road alignment and in the technical solutions included in road construction. In this way, environmental impact assessment has become a part of the modern road planning process which has been one of the central goals of the EIA Act.

The most important mitigation measures of adverse effects in the seven EIAs include:

- noise abatement using noise walls and barriers as well as speed limits
- tunnel alternatives in built-up areas and in natural landscape
- underpasses (agriculture and forestry, recreation)
- ground water protection
- infiltration of surface water
- concentration of spoil areas and landscaping
- alternative road alignments in critical landscape and natural sites as well as in noise areas
- underpass and overpass sites for animals
- long overpasses of water areas and viaducts for protecting the natural environment (also animal movements)
- landscaping, design of terrain in terms of the environment, plantings, field sowing

Statements of the coordination authorities on the EIA-processes of E 18 projects

The statements of the coordination authorities on the EIA programmes clearly describe the implementation of the EIA-process in a planning project and in interaction. According to the EIA Act, EIA-report and the statement issued on it should be considered when making a decision on the implementation of a road project. In this way, EIAs conducted on E 18 projects will guide the further planning and the actual construction of the road.

The statements issued by the coordination authorities include the statements of all issuing bodies (municipalities, the Regional Councils, regional museums, rural trade districts and local interest groups, residents) and the own statements of the Finnish Environment Institute. The statements of coordination authorities do not usually take a stand on the priority of alternatives but they examine the implementation of the EIA-process and the adequacy of impact assessment.

The summaries and central issues of the statements of the coordination authorities on EIAs of E 18 road projects include the following:

- environmental impact assessments of Road E 18 have been conducted adequately and according to the EIA legislation
- impact assessments have partly been conducted at too general level with regard to e.g. emissions and the diversity of nature. Needs for additional assessment have been presented which will be considered in further planning
- evaluation of the possibilities for improving the existing road (alternative 0+) should have been conducted in a more independent and equal way in almost every impact assessment
- on some road segments, EIA has been conducted too late with regard to the planning and decision-making of the project which has disturbed the possibilities for citizen participation. The planning of several extensive road projects has possibly been started many decades ago. The EIA Act was enacted in the middle of 1990s.
- in individual cases, the statements take stand on the priority of alignments with regard to environment, for example at the protection area of Pernajanlahti, on the Loviisa - Kotka road segment and at Hamina
- noise abatement should be studied in more detail and planned equally also for the 0+ alternatives (noise abatement is needed e.g. on Ring Road III between Vantaankoski and Tikkurila even in the existing situation, noise abatement has also been proposed for the protection area of Pernajanlahti, additional studies should be conducted at Hamina)
- further planning of ground water protection has been paid special attention to

Monitoring and the implementation of the mitigation measures of adverse effects

A monitoring programme according to the EIA Act has been presented in every EIA of projects. Usually, the monitoring has concentrated on ground water, vegetation and fauna. The monitoring of natural environment has had an impressive start on highway 7 between Koskenkylä and Loviisa at the forest area of Röisuo and the bird community of Pernajanlahti. The movements of moose and other mammals are investigated at the Röisuo underpass site by studying traces and the use of underpasses. The state of vegetation and small animals is studied in the forest area. The monitoring of the bird community has been conducted for a longer time at Pernajanlahti.

The implemented mitigation measures of adverse environmental effects on the constructed E 18 projects or projects at final road engineering phase have included ground water protection, noise abatement, landscape and fauna.

Ground water protection

Ground water protection has been implemented on the new motorway segments of highway 1 and on the semi-motorway of highway 7. Monitoring of the quality of ground water has been started simultaneously.

Noise abatement

Noise abatement will be implemented at residential and built-up areas along the new motorways. Wooden noise barriers are being planned at Karhula and noise walls have already been constructed on highway 7 between Aittakorpi - Otsola. Noise abatement has been one of the criteria for tunnel alternatives or changes in road alignments in e.g. Pernaja and Hamina.

Adapting the road to the landscape

The motorway on highway 1 between Paimio - Muurla has been adapted to landscape by using a low road embankment on the cultural landscape segments of Halikonjoki valley, Uskelanjoki valley, Kevola and Ruotsala. Long bridges instead of embankments have been used in the overpasses of water areas. The original look of rock cuttings and embankments have been preserved as much as possible by landscaping using local species of plants and species of wild fields on highway 7 between Koskenkylä - Loviisa.

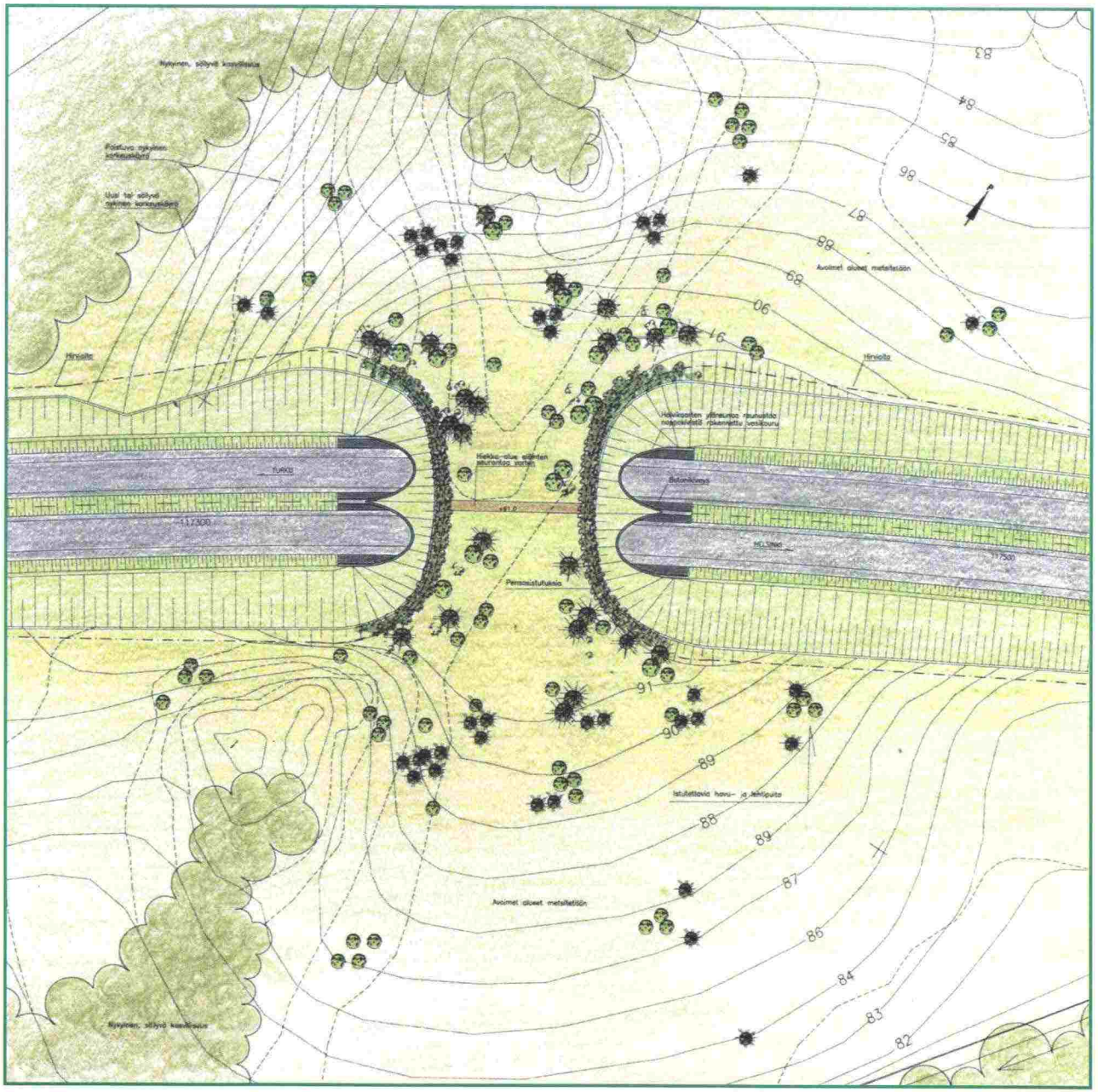
Construction of animal underpasses

Animal underpasses have been constructed for moose and other bigger mammals on highways 7 and 1. There is one long viaduct and three underpasses with larger mouths on the road segment Koskenkylä - Loviisa, which was opened in the autumn of 1998. These structures have especially been planned for moose. Moose prefer especially the long viaduct but based on the results of monitoring, they also use the underpasses of regular forest roads.

According to the experts in charge of the experiment and monitoring, the experiment with animal underpasses on highway 7 has been successful this far. Also, the public has regarded the animal underpasses as a positive development in the Finnish road planning and construction. This has significantly promoted the approval of the Koskenkylä - Loviisa road project on highway 7.

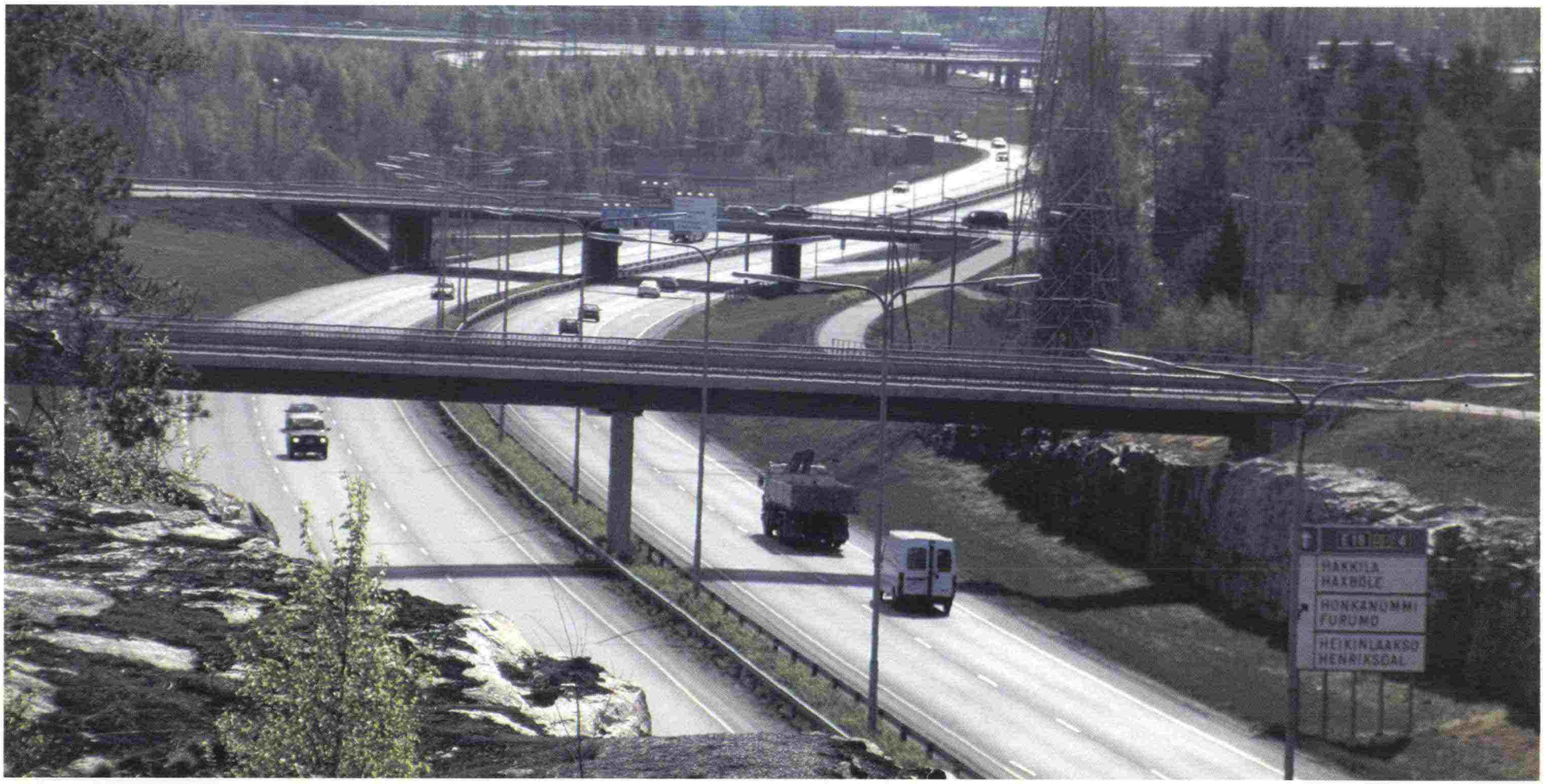
Animal underpasses will also be constructed on highway 1 between Paimio - Muurla. One of the underpasses, which is located in a valuable natural protection site of Riihojannotko, has been constructed in a way that there is no forest road connected to it. Also, a long viaduct has been constructed on this road segment as well as tunnel sections in forest areas which have been planned with gamekeepers.

The significance of animal underpasses and green bridges will increase in the planning of Road E 18. Green bridges will be constructed on the Muurla - Lohja - Lieviö road segment.



Evaluation of the EIA-process

The EIA Act is relatively new and its application procedures are under development. It can be stated that conducting a strategic environmental assessment (SEA) is still being practised, not only in Finland, but also in other parts of Europe. Part of the problems related to environmental impact assessment will be solved, if SEA and EIA will be closely connected to each other in the future. Then, for example the principle decisions on implementing or not implementing large transport projects will be made based on SEA and the decisions on transport subprojects will be made based on EIA. In the first phase, the strategic questions regarding 0+ alternative, modal split, green house emissions etc. will be studied. In the second phase, the emphasis will be on local environmental questions, as there will be hardly any possibilities for having an influence on the questions of the first phase.



5.4 Impacts on employment

According to the Development Study of Road E 18, the employment benefits of road construction with multiplier effects were estimated to be about 15 000 man years. About 130 permanent jobs were estimated to be located in the impact area of the road as a consequence of the increase in productivity and improved competitivity.

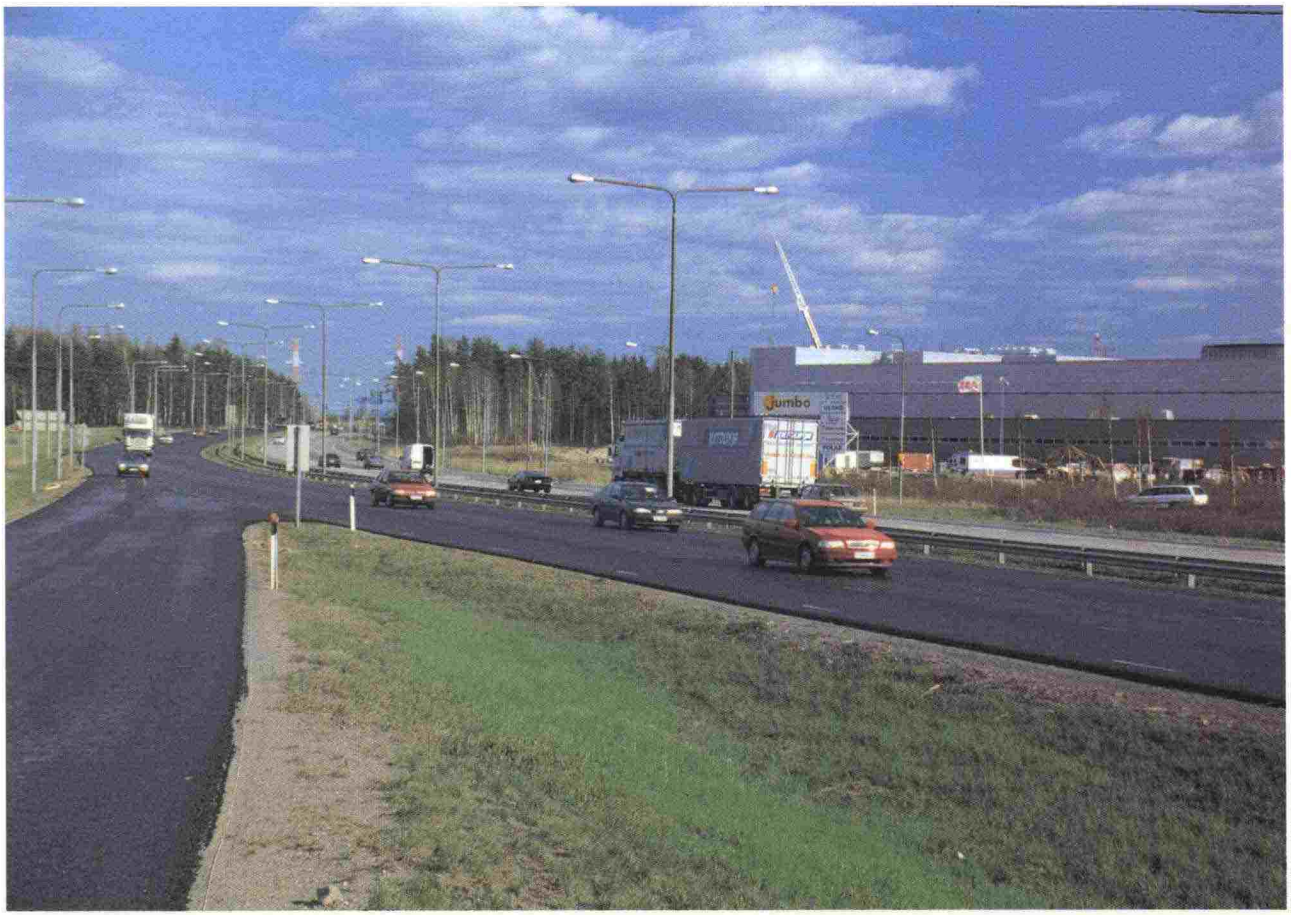
According to the prepared studies, the employment benefits of Road E 18 with multiplier effects will be 12 000 - 15 000 man years depending on the growth in productivity. This supports the estimates made in the year 1995. In terms of the price of a man year, this will add up to 360 000 - 450 000 FIM/ man year.

Road construction is one the sectors with largest employment benefits. The sectors with the largest employment benefits per investment of similar magnitude include agriculture and forestry, food production, clothing industry, trade and nutrition, telecommunication and earth and hydraulic works. The public sector only decides on the investments of earth and hydraulic works.

Impacts on employment have also been studied with regard to the timing of all Nordic Triangle projects (Ministry of Transport and Communications 1996). The impacts of accelerating or decelerating the implementation were examined in the study.

The acceleration of the projects by five years will provide significant cost savings due to scale effects and inexpensive input prices caused by the underemployment situation. The employment situation during construction would be improved by a total of 30 000 man years. The cost savings would be almost 10 % or about 1,3 billion FIM.

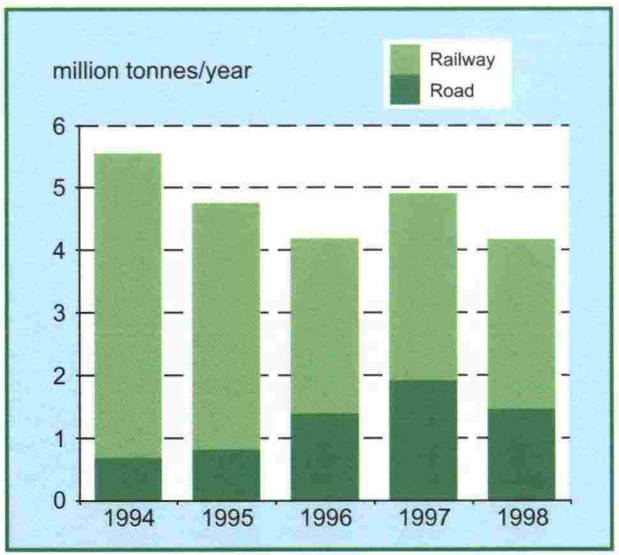
The deceleration of projects would have exactly opposite impacts. The additional costs would be about 1,5 billion FIM. Furthermore, Finnish companies would lose the competitive advantage in the Baltic and especially in the Russian markets which is provided by the rapid implementation of the projects.



5.5 Transit traffic

Transit traffic includes transports which are transported through other countries on their way from the origin to their destination. In Finland, these mainly include transports between Russia and central Europe which use the ports of southern Finland due to the insufficient port capacity in the St. Petersburg region.

There has been plenty of public discussion on transit traffic. The most common question has been, why is it worth attracting transit traffic to Finland, while for example Switzerland and Austria attempt to get rid of it. The most significant difference between these countries is the fact that transit traffic passes through a port and shifts modes in Finland which also provides for economic benefits. The transit traffic in Switzerland and Austria consists of truck traffic which passes through these countries with no stops.



Development of transit traffic 1994-1998

The amount of transit traffic has annually varied between four and six million tonnes. The amount of transit traffic is currently declining. A major share of the tonnes in transit traffic are transported by rail.

The amount of transit traffic at the ports of southern Finland in the year 1998:

Hamina	864 000 t
Kotka	2 305 000 t
Helsinki	432 000 t
Hanko	56 000 t
Turku	67 000 t
Naantali	7 000 t
Total	3 731 000 t

A study on the economic impacts of transit traffic has been conducted in Finland (Centre for Maritime Studies at the University of Turku 1995). The study is based on the traffic of the year 1994 when the amount of transit traffic at the Finnish ports was about 6 million tonnes. It was 4,1 million tonnes in the year 1998. During the year 1998, a total of 77 million tonnes of goods was transported through the Finnish ports.

The factors included in the study were the direct revenues of different instances from transit traffic as well as the operating and investment costs of transport infrastructure as well as external costs caused by transit traffic. These include the adverse effects of exhaust gas emissions, noise and accidents.

According to the results of the study, the sales revenue of transit traffic was a total of 1,3 billion FIM in the year 1994. The largest share of revenue was obtained by the VR Corporation and liquid transport operators. The share of added value of the gross income was about 62 % or transit traffic increased the national income by about 830 million FIM.

The employment benefits of transit traffic were about 2700 persons in the year 1994 which were mainly allocated to the railway sector.

The income from transit traffic is especially dependent on the domestic share of the transport chain as well as on the quantity and quality of traffic. If freight is transported only by foreign operators, the income will be lower than the costs of traffic.

As far as the exported tonnes in freight transport are concerned, the share of domestic transports was 30 % and the share of Russian transports was 70 % in the year 1998. As the amount of transports has declined, the share of Russian transports has further increased and was already 80 % in January of 1999.

This proportion is the opposite in import transports: the share of domestic transports was 80 % and the share of Russian transports was 17 %. This is due to the fact that a significant share of imports consists of timber and the Russian operators do not have the required vehicle fleet for transporting it.

6. IMPLEMENTATION

6.1 Preparedness in planning

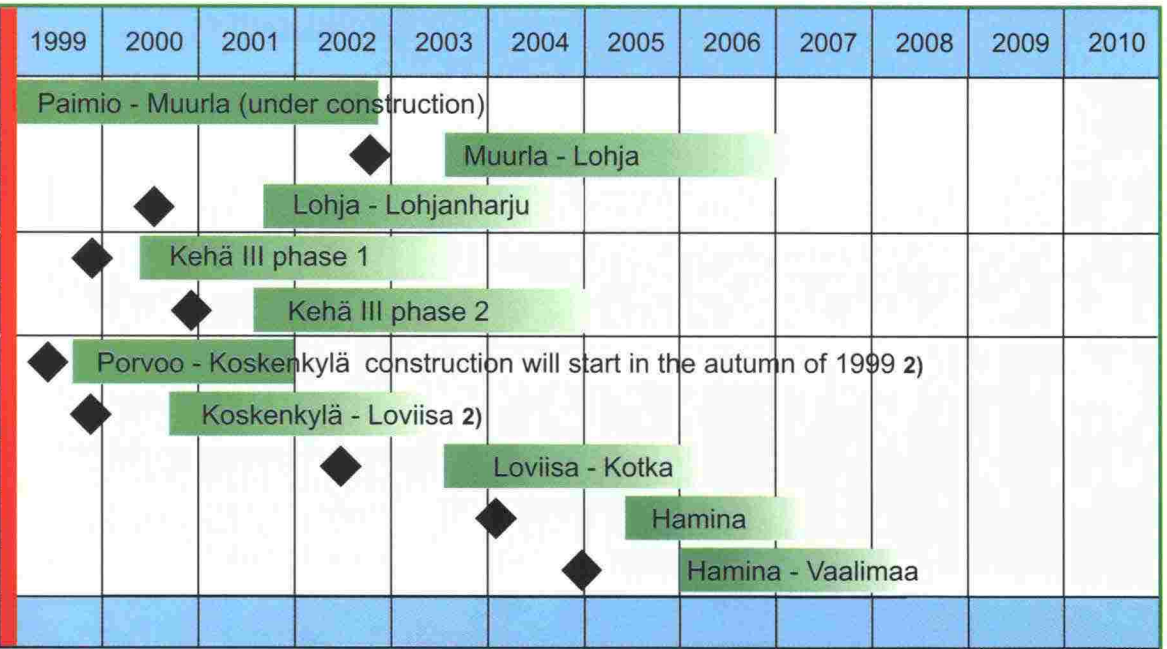
The preparedness in planning of Road E 18 and the situation with regard to environmental impact assessment by subprojects are presented in the following section. The list does not include the subprojects which are under construction or will be started in the year 1999. These include the implementation of highway 1 between Paimio - Muurla and the construction of another carriageway for highway 7 between Porvoo - Koskenkylä.

Preliminary road engineering plans have been prepared for the segment **Muurla - Lohja (Karnainen)** based on the project decision by the Ministry of Transport and Communications in the year 1990. The project has been examined in two preliminary road engineering plans which have been prepared for the segments Muurla - Lahnajärvi (1996) and Lahnajärvi - Karnainen (1993). The preparation of the final road engineering plan was started in the year 1998.

Preliminary road engineering plan has been prepared for the segment **Lohja - Lohjanharju (Lie-viö)** in the year 1993 (Karnainen - Lieviö). The final road engineering plan was completed in the autumn of 1998.

A legal environmental impact assessment has been prepared for the **entire segment Muurla - Lohjanharju** which was completed in the year 1996. According to the statement issued on the EIA report, the studies are adequate for comparing the motorway and the improvement of the

E18 ROAD CONNECTION	Costestimate Mmk	1999-2010 1)
Turku - Helsinki	890	
Highway 1	1600	1600
	360	360
Helsinki Metropolitan area	450	450
Ring Road III	390	390
Helsinki - Vaalimaa	270	
Highway 7	90	90
	700	700
	350	350
	300	300
TOTAL (Mmk)	**5400**	**4240**



◆ **Preparedness in planning**
(final road engineering plan approved and legally valid)

1) no starting decisions
2) second carriageway

existing road. The Ministry of Transport and Communications made an action decision on the project in February of 1998 or a decision for further planning.

A project decision has been made on the improvement of **Ring Road III** between Vanhakartano - Vantaankoski (phase 2) in the year 1992, after which a development study has been prepared for the road segment in the year 1996. The preparation of the preliminary road engineering plan is underway.

An environmental impact assessment, which was completed in August of 1996, has been prepared on the improvement of **Ring Road III** between Vantaankoski - Tikkurila (phase 1). The final road engineering plan for the segment was completed in the year 1998.

An environmental impact assessment has been prepared for the segment **Porvoo - Koskenkylä** in the year 1997. The final road engineering plan for the segment has been completed.

An environmental impact assessment has been prepared for the segment **Koskenkylä - Loviisa** in the year 1993. The preparation of the final road engineering plan is underway.

The preliminary road engineering plan for the segment **Loviisa - Kotka** was completed in the autumn of 1998. The implemented alternative will be selected from the alternatives presented in it based on statements.

A legal environmental impact assessment (EIA) has been prepared **at Hamina** in which five alternative road alignments were compared. Based on the statement issued by the Finnish Environment Institute and the negotiations with the Ministry of the Environment and the Ministry of Transport and Communications, preliminary road engineering plans were prepared for two alternatives, namely tunnel alternative Summa - Tervasaari - Tallinmäki and northern alternative Summa - Husula - Haru. The road alternative crossing Haminanlahti was specified in the same context.

The Regional Government of Kymenlaakso decided in January of 1999 that the draft regional plan will be prepared according to the standpoint of the Finnish National Road Administration based on the northern alternative. The project cannot be implemented until it is approved by the administration.

A feasibility study has been prepared for the segment **Hamina - Vaalimaa** in the year 1994. The main alignment of the road is not decided.

6.2 Implementation programme

The construction projects of Road E 18 were programmed in the Development Study based on the profitability of the projects, financing possibilities and the flexible alternation of construction sites.

The enclosed table shows the implementation of Road E 18 according to the preparedness in project planning. The project cannot be started until the final road engineering plan has been approved and it is legally valid.

The duration of the projects has been marked based on the fastest possible implementation. In practice, this means either the use of the aggregate financing method or the DBFO method.

The project Paimio - Muurla is underway and Porvoo - Koskenkylä will be started in the autumn of 1999.

The ministerial working group on transport infrastructure published its report in December of 1998. It proposes that the annual financing for road maintenance will be increased by 600 million FIM from the existing level. The report proposes that the E 18 project of Ring Road III between Lentoasemantie - Tuusulantie will be started during the period of 2000 - 2003.

6.3 Financing

The need for financing of the incomplete projects of Road E 18 and the projects which have not been started is about 5000 million FIM after the year 1999. The share of incomplete projects of this (including Porvoo - Koskenkylä) is 900 million FIM. The cost estimate of the motorway between Loviisa and Kotka has significantly exceeded the previous estimates in connection with the preparation of more detailed plans, but the changes are small with regard to other projects

Implemented financing of E 18 projects

The development of Road E 18 has a high priority, even though the financing possibilities have become more stringent, but optimal financing have not quite been achieved recently in any of the larger road projects which have budget financing .

The state has taken almost a 2 billion FIM inexpensive, long-term loan from the European Investment Bank for the construction of Road E 18. About 25-30 million FIM/year of direct support has been received for the planning, capital costs and telematic experiments of the project from the development fund of TEN-networks during the years 1995-1998. The national authorities have, however, the main responsibility for the implementation of TEN-projects. Finland will gain the most benefits of the development of the Nordic Triangle and the project is connected to the so-called *Northern Dimension* which includes e.g. bringing Russia and the EU closer to each other and which has currently been actively promoted by Finland in the EU. The promotion of the Nordic Triangle projects is one concrete indication of the fact that Finland firmly supports this development view.

Alternative financing methods

The private/DBFO method, which has been adopted for Lahdentie, has changed the thinking with regard to the financing of large road projects. The traditional budget financing with annual payments is not committed to any more, if some other method can clearly be argued for and can be legally implemented. Due to insufficient experience so far, new projects with the above mentioned DBFO financing method have not been started, but instead the so-called aggregate financing method has been decided to be applied for the project Porvoo - Koskenkylä.

In the **traditional budget financing,** the financing of the project is determined annually in connection with the state budget. The financing for the forthcoming years is uncertain in advance which makes the programming of the work as well as the forming of large contracts and competitive bidding for the project more difficult.

In the **aggregate financing method**, financing is provided conclusively for the entire project at the same time in the state budget. The entire project can be contracted out when the contractor can utilise the scale effects of the project and reach an optimal time schedule in the speed of construction.

In the **DBFO method** (design-build-finance-operate), the implementation of the project is financed outside of the state budget, and the implementing party will be gradually reimbursed for the investment as well as for its financing expenses afterwards. Similar scale and speed effects to the aggregate financing method are connected to the implementation. In addition to external financing, the method can also include other responsibilities as different variations to the implementing party as well as different alternatives for defining the payment. In the method applied for Lahdentie, the responsibility of the implementing party also includes final road engineering and road maintenance for 15 years after the completion of the project. The road company will be reimbursed based on the so-called shadow toll system or the accurate traffic counts on the road. The unit values of shadow tolls have constituted the central criteria for competitive bidding.

If the DBFO method will be changed so that instead of the shadow tolls, fees will be collected from the road users every time, this is called a real **toll road method**. In this case, the afterward financing from the budget is not needed any more. This method is not, however, considered suitable for the development of Finnish main roads for several reasons.

Using traditional budget financing, for example the construction of the road segment Muurla - Lahnajärvi - Lohja - Lohjanharju would take about 10-12 years, if estimated by other similar projects. The annual financing would be about 165-200 million FIM and the total costs would be 1970 million FIM (excluding the financing costs).

Using the aggregate or DBFO method, the construction would be completed in optimal time schedule, which is about 3 - 4 years.

According to the implementation method based on aggregate financing, the annual need for financing would be about 420 million FIM during construction and the total costs would be 1700 million FIM (excluding the financing costs). The construction in optimal time schedule is estimated to produce savings of about 15 % (290 million FIM) in construction costs.

In the DBFO method, the costs are allocated to the time period after the construction of the road segment. The length of this time period is 11-16 years with contract periods of 15 and 20 years, respectively. With regard to investment costs, the annual need for financing would be 190 - 240 million FIM with 15-20 year contracting period and with 4-8 % interest rate including the financing costs (excluding maintenance costs). The total

costs would be 2100 - 3840 million FIM. The share of financing costs of this is about a one-third.

The benefits of aggregate and DBFO method include fast implementation and the related national economic benefits during 6-8 years as compared to construction based on budget financing. The disadvantages of DBFO method include the high financing costs in the administrative sector of the Ministry of Transport and Communications which are 540 million FIM (4 %, 15 years) - 1850 million FIM (8 %, 20 years). In budget financing, the financing costs are allocated to the Ministry of Finance. This allocation of interest expenses is not significant as far as national economy is concerned.

The transport economic benefits of rapid construction have been estimated above by calculating the present values of investments and savings for different methods during a 30 year counting period (construction will start in the year 2004, interest rate is 6 %). In DBFO method, the total benefit will be significantly higher than in traditional budget financing or aggregate financing. The present values of investments will be of similar magnitude due to the timing and allocation of payments to a longer time period in the DBFO method. The transport economic benefits will be about 500 million FIM higher in aggregate and DBFO method than in traditional budget financing.

In the report by the ministerial working group on transport infrastructure (LM 48/98), the following budget technical changes are proposed:one-time allocation of the required financing for the road development projects and removing of the annual frame from budget. In this way, the costs of projects would be decreased by 10-15 %.

If DBFO method is used, the financing costs (about 1/3 of the cost of the DBFO contract) will not be budgeted as project costs, because this is not the practice in projects of normal budgetary procedure.

If the above mentioned principles were applied, the different financing methods would be comparable with regard to national economy, and depending on the project, the most inexpensive and efficient method could be selected.

APPENDIX: Press review of Road E18, viewpoints to frequently asked questions

1 Press review

One part of the monitoring study was the press review of the discussion on Road E18. The most thorough review was conducted on the papers published during the year after the completion of the Development Study. After that, the focus of the discussion was moved from the road corridor to the problems of single subprojects.

There were a total of 1118 articles about Road E18 in the reviewed papers from April of 1995 to May of 1996. A total of 579 articles had a positive tone, 150 articles had a negative tone and 389 articles were neutral. Most of the writings were ordinary articles and only a small share consisted of articles with opinions. A larger share of the writers expressing an opinion were against the project.

The often expressed questions and repeatedly misundestood issues were also collected. One of them was a wrong interpretation that the Road E18 will change transit traffic to be transported through Southern Finland to St. Petersburg by trucks. Road E18 has been examined from some single viewpoint in many articles and outlining all of its roles (road with international, regional and local traffic, part of the sea, air and ground transport system, supporting of regional development plans etc.) has been difficult. In connection with the writings about Road E18, discussion has also been brought up on some important principal questions. The most essential problems have been studied in the following section.

2 Viewpoints on the questions about Road E18

Will the construction of motorways increase traffic?

A new motorway contributes to many changes in a transport system. Traffic will be diverted from minor road network to road network with higher standard (change in traffic assignment). Changes in destination choice can occur with changes in accessibility. These factors will promote the smooth traffic operations and improve traffic safety. Vehicle operating costs will also decrease.

Part of the changes in traffic are due to the change in modal split. Shifts can occur from public transport, even if the operating conditions of public transport will also improve. The level of service of public transport will be promoted by e.g. providing the most important stops with park & ride and kiss & ride opportunities in the vicinity of built-up areas. Also, the guidance systems of public transport have recently been developed.

Changes in traffic can also be caused in the long run by the reaction of land use to the new situation and changes in accessibility in different areas. Residents and jobs will locate along good traffic connections when the origins and destinations of traffic flows will also change.

If controlled, this phenomenon will make the coordination of traffic and land use more efficient, but an uncontrolled situation may lead to the dispersion of urban structure with related negative phenomena. Municipalities can control this development through their zoning monopoly.

According to studies, the improved connections will also produce totally new trips by about a share of 3 % of the total traffic volume of the road. This would not have happened without the improvement of the transport system. Only in this case, we are dealing with new traffic flows. This is reflected in the general increase of mobility and can be considered as part of the increase in general well-being, an improved possibility of people to fulfil their different needs. The negative side of this development can include the increase in hazardous environmental impacts related to the traffic growth.

Will the construction of motorways prevent the compliance with the international emission agreements and will it comply with the principles of sustainable development?

This question has to be examined as a whole and from an extensive international viewpoint. Climatic changes can best be prevented if all nations participate in the reduction of emissions for their part and the reduction of emissions will be directed to the most efficient targets. The taxation of using an automobile in Finland is at high level in Europe. This will provide for a higher threshold of using an automobile in Finland than in other countries. In this respect, we have fulfilled our obligation in the transport sector in Finland at least to the same extent as in other countries.

Emission agreements and goals have to be followed. Pricing is an efficient way of reducing emissions. Currently, the taxation of road traffic in Finland clearly covers the costs of traffic and development investments with their external effects (= e.g. emission problems). It would be important to reduce emissions in other sectors (the share of traffic in the energy con-

consumption of Finland is about 18 %, as it is an average of 29 % in the EU countries) if it can be achieved more efficiently than in the transport sector. With the help of the developing emissions trading, the reduction of emissions abroad can also prove to be one solution. If this is not possible for political or other reasons, the taxation of traffic should be further increased. This would reduce the traffic volumes and emissions but it would not remove the need for constructing E 18 road segments which clearly exceed the profitability level.

It should also be considered that price increases would lead to sustainable development which, in addition to sustainable environmental policy, will also include sustainable social and economic development, as all of these components need each other. The implementation of sustainable environmental policy does not have a sustainable basis without economic efficiency and social balance.

Will motorways increase environmental problems?

Motorways will both promote and decrease environmental hazards. The greatest problems are often connected to construction as well as to the values of landscape, nature and the history of culture.

The net effect of the change in noise and other emissions will usually be positive due to the fact that a smaller number of people will be disposed to them, as the traffic volumes and congestion will decrease in the vicinity of populated areas.

Traffic safety will be improved in the entire network almost without exception, as the kilometres travelled in traffic will be moved to road types with high level of traffic safety.

Due to the improved safety, the risks related to the transports of hazardous goods will also decrease. The risks related to the contamination of ground water will be reduced in advance already in the construction phase of roads by using efficient technical solutions.

It is also possible to substantially reduce many other environmental hazards by using modern planning methods. Environmental impact assessment process is a legal way of identifying and preventing environmental problems and listen to the views and detailed desires of citizens. Legal environmental impact assessment has been conducted or will be conducted on all constructed motorway segments and they will be taken into consideration in the implementation. The Ministry of Transport and Communications has also conducted a so-called strategic environmental impact assessment on Road E 18.

Should the investments in road traffic be used for the development of railway traffic?

An equal national economic profitability using the same calculation principles is required for road and railway investments. There are also railway investments which are profitable and thus should be implemented. Several significant railway investments are underway and under planning.

Both road and railway traffic have their own distinct role: railway traffic serves best the long-distance freight and passenger traffic as well as the land use in the vicinity of stations. Road network is vast and extensive and thus provides the best alternative especially to those trips and transports which are not within the reach of the railway network. The share of road transport (private vehicles and buses) is about 95 % of the passenger trips, also about 95 % of the transported freight tonnes and about 65 % of the tonne kilometres travelled. Based on the above mentioned figures, it can be understood that railway traffic, even if developed, can only substitute for a small share of the trips in road traffic and the development of road traffic is necessary. Road traffic is the dominating mode of transport also in countries where the railway network is very dense. The average share of road traffic of the freight tonne kilometres travelled is about 72 % in the EU countries.

Road E 18 has a parallel railway connection which has, however, a separate alignment to the road. Both traffic connections serve the same transport corridor but they mainly serve users at different location and transport different types of goods. Therefore, the traffic connections do not substitute for but supplement each other.

One important principle in European and Finnish transport policy is the development of intermodal cooperation. This principle is based on the fact that all modes of transport are needed and the special benefits of each mode should be utilised in a best possible and economically efficient way. Thus, the actual need - the entire trip chain - could be made as flexible and economic as possible. One of the most important tasks of Road E 18 is to serve as a connection to the passenger harbours and freight ports in southern Finland, to serve the Helsinki-Vantaa international airport as well as serve the trip chains of freight and passenger traffic on road segments. The measures aiming at these goals will be implemented if necessary and possible. They are most often related to public transport operations, guidance and information, improvement of terminal connections etc.

Will the traffic volumes require a motorway construction?

The life span of motorways is at least 50 years and it will create a firm starting point for community development in the term of 100 years. Planning, decision and hearing phases of different degree as well as construction will easily take ten years. After that, the road will be in use for decades. Due to the long life span, the decision making has to be based on traffic forecasts which in turn are based on estimates about e.g. economic development, car ownership, the amount of population and its structure and land use. The Finnish National Road Administration has experience in preparing these forecasts for decades and monitoring data has indicated that the forecasts are quite accurate also in the long run.

The argument for constructing a motorway is not just the traffic volume, even though the Ministry of Transport and Communications and the Finnish National Road Administration have recorded indicative traffic volume criteria. Also, the character of traffic and the need for separating traffic flows of different character as well as long-distance and long-term views create the basis for construction.

Even a good technical standard of a two-lane road will only provide for the satisfactory level of service of the road up to a maximum daily traffic of 10 000 - 12 000 vehicles. It should be noted that vehicles are discussed in Finland without specifying for their size. Another common way is to talk about vehicle units when for example a full trailer truck corresponds to several private cars depending on the road conditions.

The central indicator of the need for road investments is the national economic profitability. Practice has shown that the level of profitability will usually be reached when the daily traffic volumes exceed 12 000 vehicles. According to forecasts, this traffic volume will be exceeded on all road segments of E18 at their estimated date of completion or shortly after.

Profitability is measured by the so-called cost-benefit ratio which should be at least 1,0 so that the project would be profitable (all benefits discounted to the same year should equal to all investments for that year). Due to the limited state budget, only those investments will be implemented which have a benefit-cost ratio of significantly greater than 1,0. Road E18 is also included in this category and thus investments are made on it, as it is one of the most profitable Finnish road projects - not because it is Road E18.

As a consequence of limited investment possibilities and high demand for benefit-cost ratio, the profitability of implemented projects will remain even if the basic assumptions (such as estimates of traffic volumes or construction costs) would change even to great extent. In this sense, the risks of misdirected investments are quite small. Investment and maintenance costs, vehicle and accident costs, time costs and external effects, such as changes in noise and other emissions, are considered in profitability calculations.

Safety is the argument for motorway construction. Are they really so safe?

The safety effect of motorways is significant due to two reasons. First, the number of injury accidents is 6 and the number of fatal accidents is 0,4 per 100 million vehicle kilometres on motorways, as the corresponding figures on two-lane roads are 10 and 1,4, respectively. The risk of getting involved in a fatal accident is 3,5 times higher on a two-lane road as compared to a motorway.

The reasons for the better safety on motorways include the non-existence of intersecting traffic and head-on collisions which will not occur on motorways. Secondly, it has to be noted that part of the traffic in other road network will be diverted to motorways and thus the accidents in other network will decrease more than they will increase on motorways.

Why the existing road will not be improved instead of constructing a motorway?

Improving of the existing road instead of constructing a motorway is often a feasible alternative. This alternative has also been studied on Road E18 and - due to the delay in investment possibilities - has been implemented in some parts.

For example on highway 1, the alternatives for improving of the existing road have been included in all phases, but they have been removed as not being so feasible with regard to traffic safety, smooth traffic operations and national economy. The impacts of improving of the existing road on the residents along the road would be significant and clearly more people would be susceptible to disadvantages than along the new motorway alignment which is now under planning.

The altitude and alignment of the road should be changed at several sites. The disadvantages will be emphasised in residential areas, where residences locate under the road alignment or in the immediate vicinity of it. Noise abatement measures could not be constructed at every site, as the houses locate very close to the road.

Junctions should be removed in the connection with improving of the existing road which would require the construction of a parallel road network to the highway which would serve local traffic. E.g. slower vehicles, such as tractors, light motorcycles and bicycles could only be driven on the parallel road. Parallel

roads would further extend the space needed for the road.

Removing of junctions and constructing of parallel roads will cut through building lots of the area, change existing road connections and provide for longer trips. This will disturb the everyday life of residents. Improving of the existing road is cheaper than constructing a motorway, but road improvement will not provide for similar benefits as motorway construction. In this way, motorway construction is more economical as a whole when compared to improving of the existing road. Smoother traffic operations and reduced number of accidents provide for more savings in the motorway alternative.

As the traffic volumes grow, a threshold will be reached when the construction of a motorway will be more profitable than the improvement of the existing road, which also has costs. If exceeding of this threshold can clearly be seen beforehand, it is not worth considering the improvement of the existing road because the duration of the investment will be short.

Motorways have also been constructed in phases so that only one carriageway and part of the structures (bridges, rock cuttings etc.) for the other carriageway have been constructed first. In this way, the need for financing for the first phase has been reduced but the total construction costs will be higher than for one-time construction, which will provide 30-40 % cost savings for the other carriageway.

Research and experiment work is being conducted all over the world for finding the road type that would best serve traffic in circumstances where a regular two-lane road is an insufficient solution but a motorway of full standard is an excessive solution. The Finnish National Road Administration has studied and adopted narrower roads with two carriageways and four lanes.

Will Road E18 be needed for the Russian traffic? Will the transports to central Europe be diverted to other routes?

The traffic crossing the Russian border is important for the trade and tourism of Finland, as it is a significant source of income to Finland. Part of this traffic is transit traffic which provides income for the Finnish sea traffic and for the port and transport operations. This income is higher than the costs of transit traffic including the so-called external costs (e.g. noise and other emissions). In this sense, the situation in Finland differs significantly from the situation in e.g. Switzerland where the problems of transit traffic are emphasised but the income remains small. This income will decrease in Finland if the use of foreign ship and vehicle fleet as well as employment will further increase.

Traffic crossing the border (of which transit traffic is only a part) constitutes, however, a small share of the traffic on Road E18 and it cannot be used as an only argument behind the need of road construction. The share of Russian traffic is significant only between Hamina - Vaalimaa. According to the Road E18 implementation programme, the road segment Hamina - Vaalimaa is the last one to be implemented and it will be implemented in time, if necessary by the traffic volumes. This should, however, be prepared for in planning, as the economic area of St. Petersburg and the Leningrad region with its 7 million inhabitants constitute a significant potential. Also, the growth of traffic volumes is dependent on the economic and political development of this region. Economic growth by one percentage unit in this region will provide traffic growth by several percentage units between our countries. This is due to the proximity to market areas, the large size of the St. Petersburg economic area and the impact of economic subsectors which experience a more rapid growth than average.

Part of the traffic between Russia and central Europe passes now through Finland and the easternmost segments of Road E18, as this route is considered safer, more operational and smoother with regard to border crossings than alternative routes. This competitive advantage may decrease or be removed over time, but Road E18 will always have a natural impact area of its own from which transports will be directed to Road E18 anyhow. Likewise, a large share of the vehicle traffic between Finland and Russia will remain on it.

Road E18 supports especially European sea traffic which is by far the most efficient and environmentally friendly mode of transport for large quantities of freight over long distances.

How will Russia and the Nordic countries develop Road E18 and their international connections?

Due to the difficult economic situation, the possibilities of Russia have been limited for developing its own road network. In spite of this, investments have been made on Road E18. Maintenance and surfacing work has been done with the loan from the World Bank on the road segments between the Finnish border and St. Petersburg as well as between St. Petersburg and Moscow. The construction of the Vyborg by-pass road was started in the year 1998 and it will be completed in the year 1999 or 2000 depending on the progress of the work. In addition, bridge repair works and investments on making border station operations more efficient have been performed. By-pass connections

around St. Petersburg are also being improved. At present, the road segment between Vaalimaa - St. Petersburg is already considered to be in good condition.

The most significant investments in Sweden and Denmark on the Nordic Triangle include the fixed links across the Danish Straits. The Great Belt connection has been opened to traffic and the Öresund connection between Denmark and Sweden will be completed in the year 2000. The total cost of these investments is about 30 billion FIM. A share of 84 % of the road segment between Stockholm and Copenhagen is of motorway standard. A motorway connection continues from Copenhagen to Hamburg. In this way, the Nordic countries will be connected to the central European network. The investments will especially have an impact on the improvement of the relative competitivity of Sweden.

Will the EU financing be significant for the construction of Road E 18? Will the financing of the construction of Road E 18 prevent the financing of other projects?

Road E 18 is a part of the so-called Nordic Triangle and the Trans-European Network. The Nordic Triangle is one of the 14 most important European road projects. Due to this, different types of support has been received from the EU for the development which has recently amounted to about 30 million FIM/year. In addition, a loan with low interest rate has been received from the European Investment Bank for the road construction. The construction costs will also be lower, if the road can be implemented in optimal time schedule and as efficiently as possible with regard to the construction work. This is possible in the so-called aggregate and DBFO-financing method when the construction schedule is not dependent on the annual budget decisions.

It can be said that the investments on the Road E 18 will reduce the possibilities for investing to other road projects. However, Road E 18 is one of the most profitable road projects in Finland and the reallocation of the investments to other road projects would not be efficient use of resources if they will not meet the same profitability requirements than Road E 18.

What are the special services provided by a motorway? What is telematics?

A share of about 3,4 % of the length of the Finnish main road network consists of motorways, but however, a share of about 18 % of the traffic volumes on the main network consists of motorway traffic.

In addition to better basic services (maintenance, safety, quality of environment), the concentration of traffic volumes on high-class roads will improve the possibilities for offering the users with special services. These include roadside services, guidance, information, road fixtures, road environmen and safety.

Telematics mean combined applications of telecommunication and computer techniques. Road E 18 is the experiment area for telematic applications in Finland. The telematics of Road E 18 include today e.g. variable speed limits based on weather conditions, information points of road traffic, internet applications (e.g. weather and border station information, traffic congestion forecasts) and European-wide RDS-TMC (Radio Data System - Transport Message Channel) system. With the help of this system, updated traffic information in relation to the position of the vehicle can be listened and watched on a display unit. It is also possible to set higher standards for maintenance, environmental control, guidance and services areas on motorways than on other roads, as the level of profitability will be reached more rapidly due to the concentration of traffic.

What is the role of the Finnish National Road Administration in Road E 18 project?

The Ministry of Transport and Communications provides the Finnish National Road Administration with general operational goals and prepares the budget proposals for its entire administrative sector including all modes of transport. The decisions on large projects, such as the segments of Road E 18, will always finally be made in the Parliament in the context of budget approval.

The task of the Finnish National Road Administration is to attend to the development and maintenance of the Finnish road network in a most efficient way by meeting the demand of the society. In this role, the Finnish National Road Administration e.g. prepares and makes arguments for the development of the road network, in this case with regard to Road E 18. The demand is reflected not only in traffic volumes but also in the opinions of residents, citizen organisations, municipalities, the Regional Councils, political parties etc. as well as in plans of other authorities, all of which are monitored by the Finnish National Road Administration.

The task of the Finnish National Road Administration is also to maintain a sufficient level of preparedness in planning and implementation within its budget frame so that necessary actions can be implemented efficiently and in time schedule, if decided upon. This study is also a part of maintaining this preparedness.

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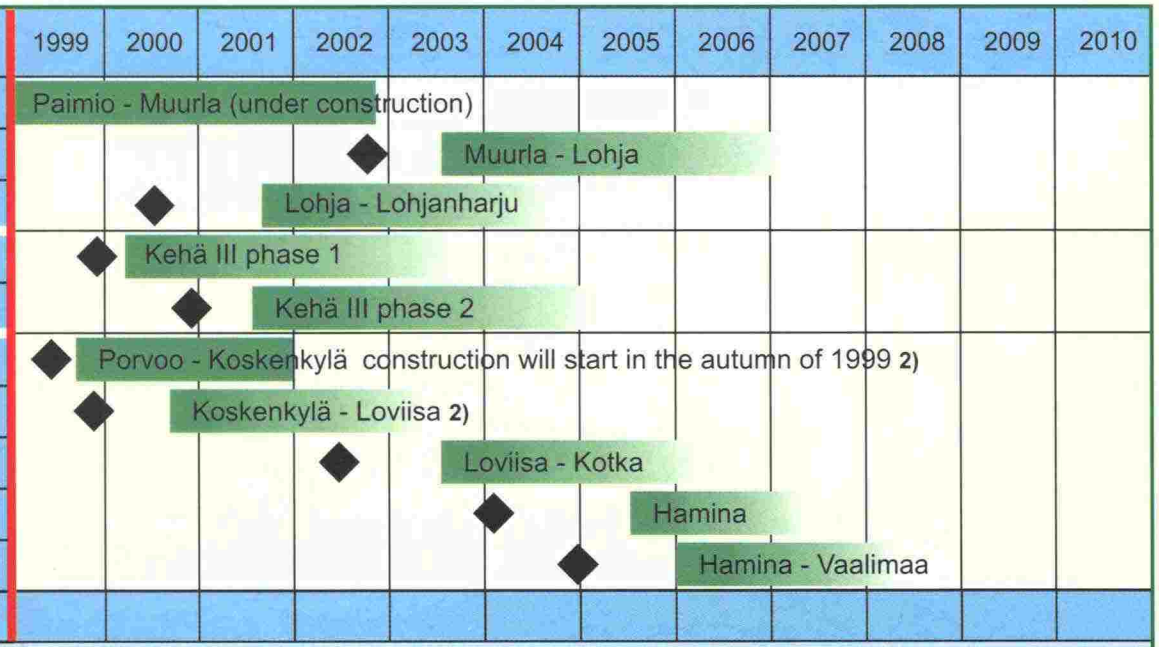
Finnra

Development of European Road E18 in Finland

Preparedness of planning and the earliest implementation of Road E18 sections

E18 ROAD CONNECTION	Cost estimate million FIM	1999-2010 1)
Turku - Helsinki	890	
Highway 1	1600	1600
	360	360
Helsinki Metropolitan area	450	450
Ring Road III	390	390
Helsinki - Vaalimaa	270	
Highway 7	90	90
	700	700
	350	350
	300	300
TOTAL (million FIM)	5400	4240



◆ **Preparedness in planning**
(final road engineering plan approved and legally valid)

1) no starting decisions
2) second carriageway